Apprenticeship and Industry Training

Motorcycle Mechanic

Apprenticeship Course Outline

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Government of Alberta

Apprenticeship and Industry Training

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Motorcycle Mechanic
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Course Outline

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Apprenticeship

Apprenticeship is post-secondary education with a difference. Apprenticeship begins with finding an employer. Employers hire apprentices, pay their wages and provide on-the-job training and work experience. Approximately 80 per cent of an apprentice's time is spent on the job under the supervision of a certified journeyperson or qualified tradesperson. The other 20 per cent involves technical training provided at, or through, a post-secondary institution – usually a college or technical institute.

To become certified journeypersons, apprentices must learn theory and skills, and they must pass examinations. Requirements for certification—including the content and delivery of technical training—are developed and updated by the Alberta Apprenticeship and Industry Training Board on the recommendation of Motorcycle Mechanic Provincial Apprenticeship Committee.

The graduate of the Motorcycle Mechanic apprenticeship program is a certified journeyperson who will be able to:

- repair and maintain motorcycles and ATVs which are powered with internal combustion engines
- comprehend work orders, technical bulletins and estimates, and relate the information to the job at hand
- interpret warranty policy in terms of service reports, component failures and analysis records
- when his/her Journeyperson Certificate has been earned, the Motorcycle Mechanic may opt to specialize in the repairing, rebuilding and servicing of any one or more of the many assemblies of the modern motorcycle
- have executive and supervisory opportunities in the motorcycle industry which are frequently available to trained and certified mechanics with above capabilities and motivation
- be able to familiarise him/her with the work experience of closely allied equipment: e.g. snowmobiles, outdoor power equipment
- perform assigned tasks in accordance with quality and production standards required by industry

Apprenticeship and Industry Training System

Industry-Driven

Alberta's apprenticeship and industry training system is an industry-driven system that ensures a highly skilled, internationally competitive workforce in more than 50 designated trades and occupations. This workforce supports the economic progress of Alberta and its competitive role in the global market. Industry (employers and employees) establishes training and certification standards and provides direction to the system through an industry committee network and the Alberta Apprenticeship and Industry Training Board. The Alberta government provides the legislative framework and administrative support for the apprenticeship and industry training system.

Alberta Apprenticeship and Industry Training Board

The Alberta Apprenticeship and Industry Training Board provides a leadership role in developing Alberta's highly skilled and trained workforce. The board's primary responsibility is to establish the standards and requirements for training and certification in programs under the Apprenticeship and Industry Training Act. The board also provides advice to the Minister of Advanced Education and Technology on the needs of Alberta's labour market for skilled and trained workers, and the designation of trades and occupations.

The thirteen-member board consists of a chair, eight members representing trades and four members representing other industries. There are equal numbers of employer and employee representatives.

Industry Committee Network

Alberta's apprenticeship and industry training system relies on a network of industry committees, including local and provincial apprenticeship committees in the designated trades, and occupational committees in the designated occupations. The network also includes other committees such as provisional committees that are established before the designation of a new trade or occupation comes into effect. All trade committees are composed of equal numbers of employer and employee representatives. The industry committee network is the foundation of Alberta's apprenticeship and industry training system.

Local Apprenticeship Committees (LAC)

Wherever there is activity in a trade, the board can set up a local apprenticeship committee. The board appoints equal numbers of employee and employer representatives for terms of up to three years. The committee appoints a member as presiding officer. Local apprenticeship committees:

- monitor apprenticeship programs and the progress of apprentices in their trade, at the local level
- make recommendations to their trade's provincial apprenticeship committee (PAC) about apprenticeship and certification in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- make recommendations to the board about the appointment of members to their trade's PAC
- help settle certain kinds of disagreements between apprentices and their employers
- carry out functions assigned by their trade's PAC or the board

Provincial Apprenticeship Committees (PAC)

The board establishes a provincial apprenticeship committee for each trade. It appoints an equal number of employer and employee representatives, and, on the PAC's recommendation, a presiding officer - each for a maximum of two terms of up to three years. Most PACs have nine members but can have as many as twenty-one. Provincial apprenticeship committees:

- Make recommendations to the board about:
    - standards and requirements for training and certification in their trade
    - courses and examinations in their trade
    - apprenticeship and certification
    - designation of trades and occupations
    - regulations and orders under the Apprenticeship and Industry Training Act
- monitor the activities of local apprenticeship committees in their trade
- determine whether training of various kinds is equivalent to training provided in an apprenticeship program in their trade
- promote apprenticeship programs and training and the pursuit of careers in their trade
- consult with other committees under the Apprenticeship and Industry Training Act about apprenticeship programs, training and certification and facilitate cooperation between different trades and occupations
- consult with organizations, associations and people who have an interest in their trade and with employers and employees in their trade
- may participate in resolving certain disagreements between employers and employees
- carry out functions assigned by the board

Motorcycle Mechanic PAC Members at the Time of Publication

Mr. D. Fergin	Calgary	Presiding Officer
Mr. M. Gamble	Calgary	Employer
Mr. L. Standish	Edmonton	Employer
Mr. J. Sumyk	Edmonton	Employer
Mr. M. Treiber	Edmonton	Employer
Mr. Q. Ton-That	Calgary	Employee
Mr. K. Davy-Thomas	Edmonton	Employee
Mr. J. Delancey	Edmonton	Employee
Mr. C. Robertson	Edmonton	Employee

Alberta Government

Alberta Advanced Education and Technology works with industry, employer and employee organizations and technical training providers to:

- facilitate industry's development and maintenance of training and certification standards
- provide registration and counselling services to apprentices and employers
- coordinate technical training in collaboration with training providers
- certify apprentices and others who meet industry standards

Technical Institutes and Colleges

The technical institutes and colleges are key participants in Alberta's apprenticeship and industry training system. They work with the board, industry committees and Alberta Advanced Education and Technology to enhance access and responsiveness to industry needs through the delivery of the technical training component of apprenticeship programs. They develop lesson plans from the course outlines established by industry and provide technical training to apprentices.

Apprenticeship Safety

Safe working procedures and conditions, incident/injury prevention, and the preservation of health are of primary importance in apprenticeship programs in Alberta. These responsibilities are shared and require the joint efforts of government, employers, employees, apprentices and the public. Therefore, it is imperative that all parties are aware of circumstances that may lead to injury or harm.

Safe learning experiences and healthy environments can be created by controlling the variables and behaviours that may contribute to or cause an incident or injury. By practicing a safe and healthy attitude, everyone can enjoy the benefit of an incident and injury free environment.

Alberta Apprenticeship and Industry Training Board Safety Policy

The Alberta Apprenticeship and Industry Training Board fully supports safe learning and working environments and encourages the teaching of proper safety procedures both within trade specific training and in the workplace.

Trade specific safety training is an integral component of technical training, while ongoing or general non-trade specific safety training remains the responsibility of the employer and the employee as required under workplace health and safety legislation.

Workplace Responsibilities

The employer is responsible for:

- training employees and apprentices in the safe use and operation of equipment
- providing and maintaining safety equipment, protective devices and clothing
- enforcing safe working procedures
- providing safeguards for machinery, equipment and tools
- observing all accident prevention regulations

The employee and apprentice are responsible for:

- working in accordance with the safety regulations pertaining to the job environment
- working in such a way as not to endanger themselves, fellow employees or apprentices

Workplace Health and Safety

A tradesperson is often exposed to more hazards than any other person in the work force and therefore should be familiar with and apply the Occupational Health and Safety Act, Regulations and Code when dealing with personal safety and the special safety rules that apply to all daily tasks.

Workplace Health and Safety (Alberta Employment, Immigration and Industry) conducts periodic inspections of workplaces to ensure that safety regulations for industry are being observed.

Additional information is available at www.worksafely.org

Technical Training

Apprenticeship technical training is delivered by the technical institutes and many colleges in the public post-secondary system throughout Alberta. The colleges and institutes are committed to delivering the technical training component of Alberta apprenticeship programs in a safe, efficient and effective manner. All training providers place great emphasis on safe technical practices that complement safe workplace practices and help to develop a skilled, safe workforce.

The following institutions deliver Motorcycle Mechanic apprenticeship technical training:

NAIT Fairview Campus

Procedures for Recommending Revisions to the Course Outline

Advanced Education and Technology has prepared this course outline in partnership with the Motorcycle Mechanic Provincial Apprenticeship Committee.

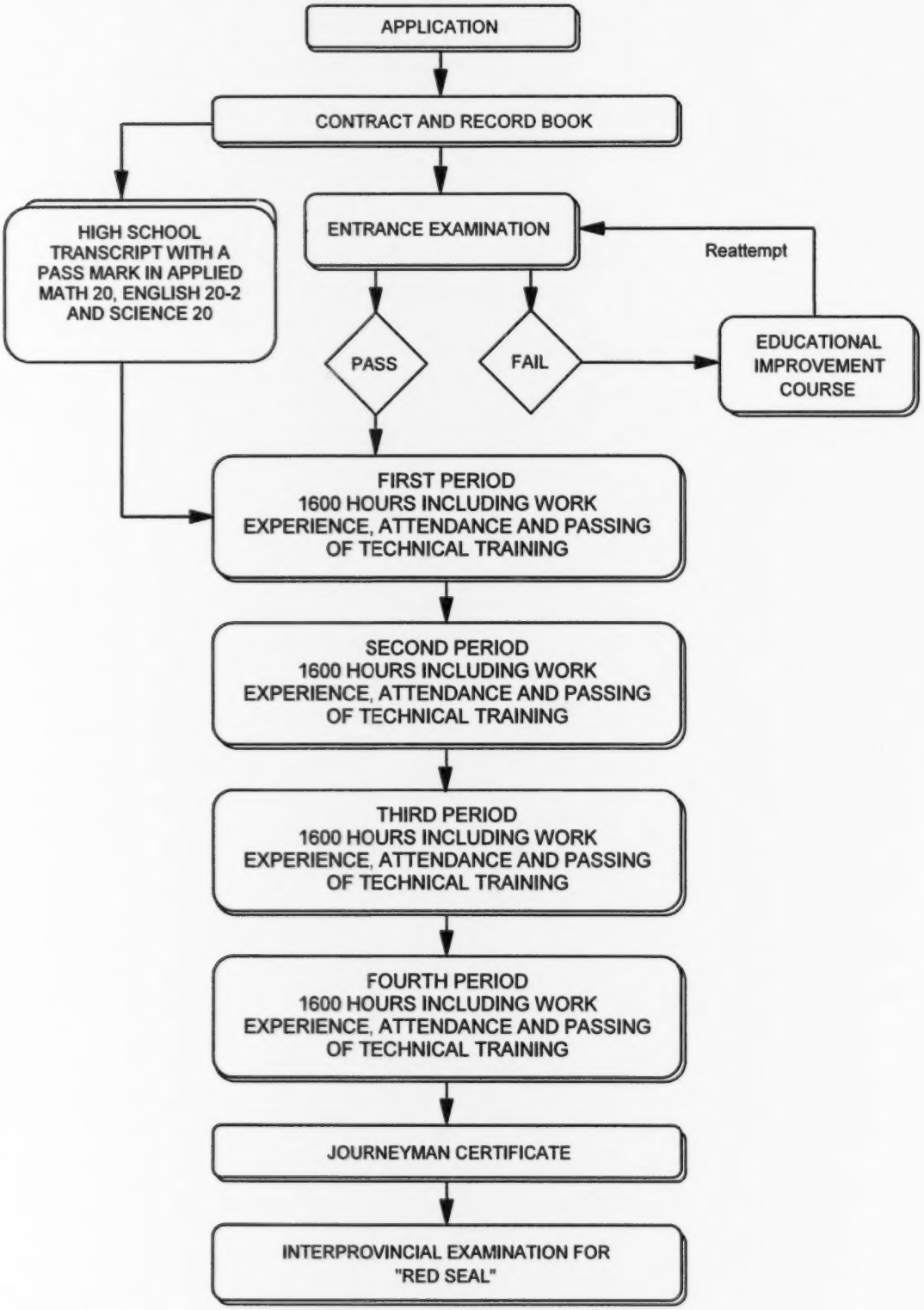
This course outline was approved on September 30, 2005 by the Alberta Apprenticeship and Industry Training Board on a recommendation from the Provincial Apprenticeship Committee. The valuable input provided by representatives of industry and the institutions that provide the technical training is acknowledged.

Any concerned individual or group in the province of Alberta may make recommendations for change by writing to:

Motorcycle Mechanic Provincial Apprenticeship Committee
c/o Industry Programs and Standards
Apprenticeship and Industry Training
Advanced Education and Technology
10th floor, Commerce Place
10155 102 Street NW
Edmonton AB T5J 4L5

It is requested that recommendations for change refer to specific areas and state references used. Recommendations for change will be placed on the agenda for regular meetings of the Motorcycle Mechanic Provincial Apprenticeship Committee.

Apprenticeship Route toward Certification


APPLICATION
CONTRACT AND RECORD BOOK
HIGH SCHOOL TRANSCRIPT WITH A PASS MARK IN APPLIED MATH 20, ENGLISH 20-2 AND SCIENCE 20
ENTRANCE EXAMINATION
Reattempt
PASS
FAIL
EDUCATIONAL IMPROVEMENT COURSE
FIRST PERIOD 1600 HOURS INCLUDING WORK EXPERIENCE, ATTENDANCE AND PASSING OF TECHNICAL TRAINING
SECOND PERIOD 1600 HOURS INCLUDING WORK EXPERIENCE, ATTENDANCE AND PASSING OF TECHNICAL TRAINING
THIRD PERIOD 1600 HOURS INCLUDING WORK EXPERIENCE, ATTENDANCE AND PASSING OF TECHNICAL TRAINING
FOURTH PERIOD 1600 HOURS INCLUDING WORK EXPERIENCE, ATTENDANCE AND PASSING OF TECHNICAL TRAINING
JOURNEYMAN CERTIFICATE
INTERPROVINCIAL EXAMINATION FOR "RED SEAL"

Motorcycle Mechanic Training Profile
FIRST PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

SHOP SAFETY, SHOP EQUIPMENT, FASTENERS AND MATERIAL AND SAFE USE OF OXY-FUEL EQUIPMENT
30 HOURS

A	B	C
Shop Safety and Trade Regulations 2 Hours	Introduction to Workplace Hazardous Materials Information System 2 Hours	Laws, Liabilities and Legalities 2 Hours
D	**E**	**F**
Fire Prevention and Control 2 Hours	Storage of Fuels and Solvents 1 Hour	Use of Shop Presses and General Shop Equipment 2 Hours
G	**H**	**I**
Use of Compressed Air and High Pressure Hot Water Cleaning 1 Hour	Materials and Fastening Devices, Thread Repairs, Thread Lockers and Sealants 9 Hours	Oxy-Fuel, Equipment, Heating and Cutting 9 Hours

SECTION TWO

TRADE TOOLS AND SHOP PROCEDURES
30 HOURS

A	B	C
Hand Tool Use 6 Hours	Electrical Testing and Service Tools 1 Hour	Parts Cleaning Tools 2 Hours
D	**E**	**F**
Measuring Tools 9 Hours	Engine Service and Overhaul Equipment 1 Hour	Engine Tune-up and Service Tools 1 Hour
G	**H**	**I**
Wheel, Suspension and Frame Service Tools 1 Hour	Power Hand Tools 3 Hours	General Shop Equipment 6 Hours

SECTION THREE

BASIC ELECTRICAL THEORY AND CIRCUITS
30 HOURS

A	B	C
Introduction to Electrical Theory and Multi-meter Usage 9 Hours	Batteries 6 Hours	Electrical Circuits 9 Hours
D		
Electrical Wiring and Connectors 6 Hours		

SECTION FOUR

MOTORCYCLE ASSEMBLY AND PRE-DELIVERY
30 HOURS

A	B	C
Receiving and Inspecting Crated New Machines 2 Hours	Reporting Shipment Damage 1 Hour	Assembly Instructions 9 Hours
D	**E**	**F**
Minor Body Part Cosmetic Repairs 3 Hours	Manufacturer's P.D.I. Checklist 12 Hours	Motorcycle Long Term and Winter Storage 3 Hours

SECTION FIVE

BASIC TUNE-UP AND MANUFACTURER'S SCHEDULE SERVICE CHECK
30 HOURS

A	B	C
Air Filters 3 Hours	Basic Carburetor Cleaning and Overhaul 3 Hours	Engine Compression, Combustion Chamber and Crankcase Sealing Tests 6 Hours
D	**E**	
Basic Engine Tune-Up 12 Hours	Manufacturer's Scheduled Service 6 Hours	

SECTION SIX

ENGINE THEORY OF 2 AND 4 STROKE ENGINES
30 HOURS

A	B	C
Two Stroke Engine Operating Principles 6 Hours	Two Stroke Engine Construction and Component Design 3 Hours	Slide Type and Constant Velocity Type Carburetor Theory 6 Hours
D	**E**	
Four Stroke Engine Operating Principles 9 Hours	Four Stroke Engine Construction and Component Design 6 Hours	

SECTION SEVEN

WHEEL AND TIRE MAINTENANCE
30 HOURS

A	B	C
Type of Wheels 1 Hour	Wheel Inspection 2 Hours	Wheel Servicing and Overhaul 15 Hours
D	**E**	
Tire Construction and Repair 3 Hours	Tire Mounting and Dismounting 9 Hours	

SECTION EIGHT

MECHANICAL AND HYDRAULIC BRAKE SYSTEMS
30 HOURS

A	B	C
Nomenclature 2 Hours	Hydraulic Brakes Theory 2 Hours	Brake Design 2 Hours
D	**E**	**F**
Brake Inspection, Maintenance and Service 9 Hours	Inspecting Brake Hoses and Bleeding Brake Fluid 6 Hours	Master Cylinder Caliper and Wheel Cylinder Rebuilding 9 Hours

SECOND PERIOD
(8 Weeks 30 Hours per Week – Total of 240 Hours)

SECTION ONE

CHARGING AND STARTING SYSTEMS
60 HOURS

A	B	C
Fundamentals of Electrical Theory Reviewed 3 Hours	Charging Systems Diagnostic Tests 3 Hours	Alternating Current Generators (Alternators) Theory 9 Hours
D	**E**	**F**
Single Phase Alternating Current Generators (Alternators) 6 Hours	Three Phase Permanent Magnet Alternating Current Generators (Alternators) 6 Hours	Three Phase Electromagnet Alternating Current Generators (Alternators) 3 Hours
G	**H**	**I**
Flywheel Magneto AC Lighting Systems 6 Hours	2-Circuit Electric Starting Systems 12 Hours	3-Circuit Electric Starting Systems 12 Hours

SECTION TWO

TWO STROKE ENGINE TOP END RECONDITIONING
45 HOURS

A	B	C
Cleaning the Vehicle for Top End Service 1 Hour	Diagnostic Testing The Engine Condition 5 Hours	Cylinder Head Removal, Cleaning, Inspection, and Repair 9 Hours
D	**E**	**F**
Cylinder, Pistons, Rings, Power Valves and Reed Cage Servicing 18 Hours	Crankshaft Bearings and Crankcase Sealing 3 Hours	Engine Top End Assembly and Break In 9 Hours

SECTION THREE

FRAMES AND SUSPENSIONS
45 HOURS

A	B	C
Frame Design, Construction and Materials 1 Hour	Front Suspension Design and Nomenclature 8 Hours	Steering Geometry and Wheel Alignments 9 Hours
D	**E**	**F**
Front Suspension Inspection, Service and Overhaul 15 Hours	Rear Suspension Inspection and Service 9 Hours	Suspension System Air Compressors 3 Hours

SECTION FOUR

FUELS, LUBRICATION AND COOLING SYSTEMS
30 HOURS

A	B	C
Engine and Gear Oils 3 Hours	Lubrication Systems Performance Tests 3 Hours	Lubrication System Inspections, Service and Overhaul 6 Hours
D	**E**	**F**
2-Stroke Engine Lubrication 3 Hours	Gasoline and Fuels 3 Hours	Cooling Systems 12 Hours

SECTION FIVE

CLUTCH SYSTEMS AND PRIMARY DRIVE SYSTEMS
30 HOURS

A	B	C
Clutch Release Mechanisms 6 Hours	Clutch System Nomenclature, Identification and Theory 6 Hours	Clutch Disassembly and Overhaul 6 Hours
D	**E**	**F**
Primary Type Kick-Start Systems 3 Hours	External Crankcase Housed Primary Drive Systems 6 Hours	Internal Crankcase Housed Primary Drive Systems 3 Hours

SECTION SIX

FINAL DRIVES
30 HOURS

A	B	C
Roller Chain Final Drives 6 Hours	Belt Drive 6 Hours	Shaft Drive 9 Hours
D	**E**	
ATV Four Wheel Drive Front Differential 6 Hour	Final Drive Shock Dampening Systems 3 Hours	

THIRD PERIOD
(6 Weeks 30 Hours per Week – Total of 180 Hours)

SECTION ONE

4-STROKE ENGINE TOP END DIAGNOSTICS AND ADJUSTMENTS
60 HOURS

A	B	C
Vehicle Preparation and Cleaning 1 Hour	Engine Top End Diagnostic Tests 5 Hours	Camshaft Timing Verification and Valve Adjustments SOHC and DOHC Engines 12 Hours
D	**E**	**F**
Remove and Replace OEM Camshafts 12 Hours	After Market Camshaft Installation – —Drop-In" Types Only 12 Hours	Hydraulic Valve Adjustment Systems 12 Hours
G		
Desmodromic Engines 6 Hours		

SECTION TWO

FOUR STROKE TOP END RECONDITIONING
60 HOURS

A	B	C
Engine Removal and Chassis Storage 2 Hours	Engine Top End Disassembly 2 Hours	Cleaning and Inspections of Top End Components 2 Hours
D	**E**	**F**
SOHC and DOHC Cylinder Head Disassembly And Inspections 6 Hours	OHV (Pushrod) Cylinder Head Disassembly and Inspection 3 Hours	OHV (Pushrod) Engine Gear Case/Camshaft Inspection and Service 6 Hours
G	**H**	**I**
Recondition Valves, Valve Seats and Valve Guides 12 Hours	Inspection of Cylinders, Pistons, Rings, Pins and Clips 6 Hours	Cylinder Reconditioning 6 Hours
J	**K**	**L**
Connecting Rod Small End Inspections and Reconditioning 3 Hours	Servicing of Integrated Cylinders and Crankcase Assemblies 3 Hours	Top End Assembly and Engine Installation 6 Hours
M		
Initial Start Up, Break In and Dynamometer Evaluation 3 Hours		

SECTION THREE

IGNITION SYSTEMS AND SAFETY INTERLOCKS
60 HOURS

A	B	C
Ignition System Fundamentals 2 Hours	Ignition System Service Tools and Diagnostic Equipment 4 Hours	Spark Plugs, Wires, Caps and Coils 6 Hours
D	**E**	**F**
Flywheel Magneto Alternating Current CDI Ignition System 6 Hours	Direct Current CDI Ignition Systems 6 Hours	Digital Controlled Transistorized Electronic Ignition Systems 12 Hours
G	**H**	**I**
Engine Management Controlled Ignition Systems 12 Hours	Ignition, Kill, Interlock Switch Systems 6 Hours	Troubleshooting Common Ignition System Problems 6 Hours

FOURTH PERIOD
(6 Weeks 30 Hours per Week – Total of 180 Hours)

SECTION ONE

AIR INDUCTION, FUEL AND EXHAUST SYSTEMS AND EMISSION CONTROLS
45 HOURS

A	B	C
Normal Aspiration and Pressurized Air Systems 2 Hours	Fuel System Tanks, Valves, Filters and Pumps 4 Hours	Carburetors and Throttle Operating Systems 6 hours
D	**E**	**F**
Fuel Injection Systems – Early Designs 3 Hours	Fuel Injection Systems with On Board Diagnostic Displays 9 Hours	Engine Management Programmed Fuel Injection Systems Using Computer Interfacing Diagnostics 6 Hours
G	**H**	**I**
Exhaust Pipes, Mufflers and Catalytic Converters 6 Hours	Exhaust Gas Analysis 6 Hours	Emission Control Systems 3 Hours

SECTION TWO

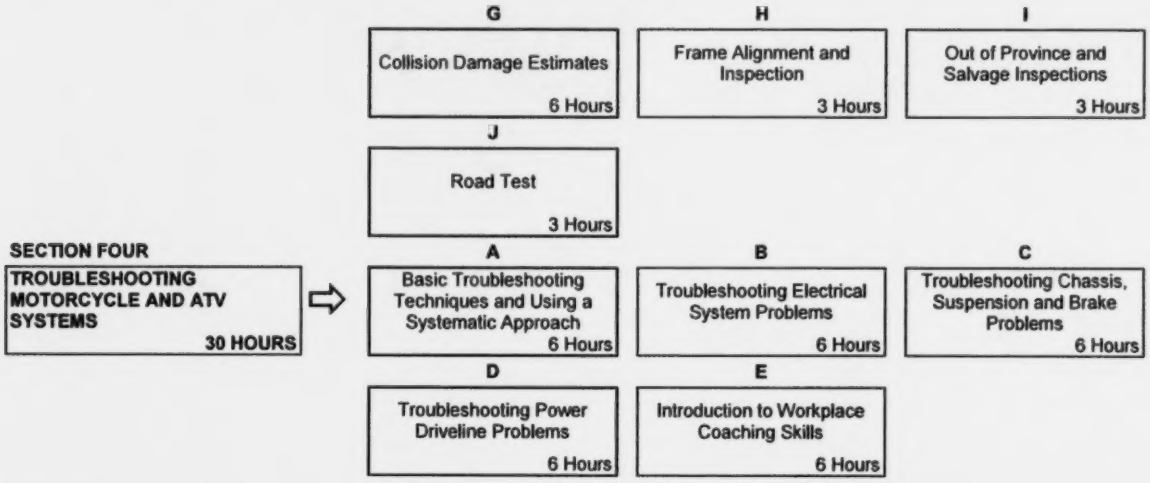
LOWER END SERVICE (CRANKSHAFT AND TRANSMISSION)
75 HOURS

A	B	C
Primary Drive Construction and Inspections (Review) 3 Hours	Engine Diagnostics, Removal and Disassembly 3 Hours	Anti-Friction Bearings Nomenclature, Inspection and Installation 3 Hours
D	**E**	**F**
2–Stroke Engine Crankcase and Crankshaft Overhaul 12 Hours	V-Twin Engine Crankshaft and Crankcase Overhaul 9 Hours	Friction Type Bearings Nomenclature, Inspections, Replacement 3 Hours
G	**H**	**I**
4–Cylinder Engine Crankshaft and Crankcase Inspection and Overhaul 12 Hours	Crankshaft Balance Factors and Crankshaft Balancer Systems 3 Hours	Transmission Manual Shift Mechanisms 6 Hours
J	**K**	**L**
Indirect Drive Multi-Speed Transmissions 9 Hours	Direct Drive Multi-Speed Transmissions 9 Hours	Shaft Drive Engine Secondary Bevel Gear Systems 3 Hours

SECTION THREE

ACCESSORY SYSTEMS, COLLISION REPAIR AND MOTORCYCLE INSPECTIONS
30 HOURS

A	B	C
Sidecar Installation (Legalities) 2 Hours	Trail Hitches (Legalities) 1 Hour	Cruise Control Systems 6 Hours
D	**E**	**F**
Instrumentation and Warning Light Systems 3 Hours	On Board Computers 2 Hours	Digital Information Displays 1 Hour



NOTE: The hours stated are for guidance and should be adhered to as closely as possible. However, adjustments must be made for rate of apprentice learning, statutory holidays, registration and examinations for the training establishment and Apprenticeship and Industry Training.

FIRST PERIOD TECHNICAL TRAINING
MOTORCYCLE MECHANIC TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE: .....SHOP SAFETY, SHOP EQUIPMENT, FASTENERS AND MATERIAL..... 30 HOURS
.....AND SAFE USE OF OXY FUEL EQUIPMENT

A. Shop Safety and Trade Regulations .....2 Hours

Outcome: ***Demonstrate communication skills and workshop safety as it pertains to Occupational Health and Safety Standards.***

1. Describe access to workplace Health and Safety Regulations through direct contact or internet access.
2. Describe personal attire and safety equipment required to perform trade outcomes.
3. Perform safe working habits to prevent accidents.
4. Describe procedures to follow if an injury or accident occurs while performing work related duties.
5. Describe the sections in the Workplace Health and Safety General Safety Regulations that apply to the motorcycle mechanic trade.

B. Introduction to Workplace Hazardous Materials Information System (WHMIS) .....2 Hours

Outcome: ***Describe what WHMIS is; its rational and major elements.***

1. Define what is meant by a WHMIS label and distinguish between supplier and workplace labels and other means of identification.
2. Describe what is meant by the following classifications:
   a) prohibited product
   b) restricted product
   c) controlled product
3. Read the information on a Material Safety Data Sheet (MSDS) and explain its purpose and limitations.
4. Describe the roles, rights and responsibilities of employer, supplier and worker in the education of workers.
5. Perform an inspection of common chemical products used in the motorcycle shop and report damaged and leaking containers to the proper authorities.

C. Laws, Liabilities and Legalities .....2 Hours

Outcome: ***Identify and explain laws, liabilities and legalities pertaining to the motorcycle mechanic trade.***

1. Describe the legal responsibilities involved in manufacturer's warranties (marked or explicit).
2. Describe the responsibilities of a mechanic in the servicing and releasing of obvious unsafe vehicles.
3. Describe the personal and shop's liabilities when road testing or storing customer's equipment.
4. Describe and explain the role and purpose of the advisory network and Provincial Apprenticeship Committee for the motorcycle mechanic trade.

D. Fire Prevention and Control.....2 Hours

Outcome: ***Identify the classes of fires, types of fire extinguishers and procedures to follow in case a fire occurs in the motorcycle shop.***

1. Describe the classes of fires:
   a) Class A - ordinary combustibles; wood, paper, packing, etc.
   b) Class B – hydrocarbon fuels, lubricants, solvents and other flammable liquids
   c) Class C – electrical equipment energized by 110-220 AC line voltage
   d) Class D - combustible metals, magnesium, etc.
2. Identify the following types of fire extinguishers and describe which classes of fire to apply them to:
   a) water; stored pressure, cartridge operated, soda acid – awareness only
   b) carbon dioxide (CO2)
   c) dry chemical – multi-purpose or specific purpose
   d) dry powder – awareness only
   e) halon gas – awareness only
3. Identify and observe smoke detector and heat detector locations in the shop.
4. Describe the application and the limitation of portable fire extinguishers including:
   a) effectiveness in relation to the stage and size of the fire
   b) recommended time intervals for inspection and servicing portable fire extinguishers
5. Describe procedures and precautions in case of an emergency including:
   a) awareness and importance of
      i) position and condition of equipment
      ii) location and operation of alarm systems and emergency exits
      iii) fire drills and designated gathering location
      iv) training and competence in using portable fire fighting equipment
      v) evacuation, specific assignments of personnel and chain of command
6. Identify potential fire hazards that can be caused by:
   a) accumulations of dust and other kinds of particulate air born matter
   b) faulty wiring and equipment on AC powered line voltage
   c) leaking or open containers that store flammable liquids
   d) accumulations of oily rags or trash that is improperly stored
   e) improper methods of handling flammables, fumes or explosive gases
   f) violations of safety rules and regulations
      i) blocking access to storage exit doors
      ii) improperly located or serviced fire fighting equipment
      iii) impairing fire door access or operation tampering
      iv) smoking in non-designated areas

E. Storage of Fuels and Solvents .....1 Hour

Outcome: ***Describe safe storage of fuels, solvents and hazardous materials.***

1. Describe, identify and inspect the use of approved storage containers and designated storage areas.
2. Perform an inspection and tag containers indicating contents used to store fuels and solvents.
3. Describe identification, interpret labelling and discuss proper disposal methods for hazardous materials.

F. Use of Shop Presses and General Shop Equipment .....2 Hours

Outcome: ***Demonstrate the competent use of shop presses and general shop equipment common to the motorcycle mechanic trade.***

1. Identify the capacities of shop hydraulic and arbour presses.
2. Describe safety procedures and guards used around presses.
3. Demonstrate how to use motorcycle pneumatic and hydraulic lift benches.
4. Demonstrate how to use and maintain air impact tools.
5. Describe how to mount an engine in an engine stand.
6. Describe operating the shop vice and perform installation of soft jaws or prismatic jaws.
7. Perform bench grinder inspection, stone dressing and identify abrasive stone materials.
8. Demonstrate how to use front and rear wheel stands.

G. Use of Compressed Air and High Pressure Hot Water Cleaning.....1 Hour

Outcome: ***Describe high pressure hot water cleaning of vehicles and perform procedures requiring the safe use of compressed air.***

1. Describe the hazards of high pressure hot water sprayers.
2. Describe the identification and mixing ratios of cleaning compounds for pressure washers.
3. Demonstrate the safe start up and shut down of high pressure hot water washers.
4. Describe personal protection required when using high pressure washers.
5. Explain the hazards of using high pressure air in the shop.
6. Identify proper eye, ear and hand protection for using compressed air and perform donning.
7. Perform coupling and uncoupling air lines and air nozzles to compressed air fittings.

H. Materials and Fastening Devices, Thread Repairs, Thread Lockers and Sealants. .....9 Hours

Outcome: ***Identify materials and fasteners commonly used in the trade and perform a thread repair procedure.***

1. Identify common metallic and non-metallic materials and describe their applications.
2. Identify types of threaded fasteners and their applications.
3. Explain torque procedures and precautions required when securing fastening devices.
4. Perform a thread cleaning operation to internal and external threaded fasteners.
5. Perform a thread cutting and thread repairing procedure to an aluminium engine component .
6. Perform removing broken fasteners with screw extractors, easy outs and reverse drill bits.
7. Describe drill bit identification and perform drill bit sharpening.
8. Describe the set-up and operation of a drill press and a drilling/milling machine.
9. Identify types of non-threaded fasteners and their applications.
10. Describe the application and use of thread locking compounds.
11. Describe the application and use of sealants, adhesives, surface prep-sprays and liquid gasket compounds.

I. Oxy-Fuel, Equipment, Heating and Cutting.....9 Hours

Outcome: ***Perform the metal cutting and heating operation safely using oxy-fuel equipment.***

1. Describe personal protective clothing and devices.
2. Describe the safe considerations for use and storage of portable gas heating equipment in the shop.
3. Describe the characteristics and handling procedures for oxygen, acetylene and propane compressed gas cylinders.
4. Identify heating and cutting torches, regulators, hoses, tips and safety valves in terms of:
   a) operation and settings to properly balance gas pressures
   b) identification of flame types and applications
   c) preparation of area to be heated and identify safety considerations
   d) maintenance and cleaning of gas heating equipment
   e) storage of hoses and torches
5. Perform basic techniques of heating and cutting using oxygen and acetylene.

SECTION TWO: .....TRADE TOOLS AND SHOP PROCEDURES.....30 HOURS

A. Hand Tool Use.....6 Hours

Outcome: ***Demonstrate the correct use of various hand tools used in the trade.***

1. Describe the types, uses and care of hand tools:
   a) wrenches – open end, box end, ratchet box end, ball end Allen, hex type
   b) socket sets – deep, shallow, 6 point, 12 point, thin wall, impact type, hex, torx
   c) pliers – slip-joint, needle nose, side cutters, snap-ring, hose clamp, hooked and pin spanner
   d) screwdrivers – Phillips, flat, torx, cotter pin puller
   e) hammers – dead blow, brass, plastic, ball peen, lead
   f) files – flat single cut, half round double cut, round, rat tail, triangular
   g) punches - pin, alignment, center and chisels – flat and cape
   h) hack saws and blades
   i) pry bars and holding devices
   j) impact driver and impact bits
   k) adjustable small mirrors, magnetic and non-magnetic pick up tools

B. Electrical Testing and Service Tools ..... 1 Hour

Outcome: ***Demonstrate the correct use of the following electrical testing equipment.***

1. Describe the uses and care of electrical testing and service tools – awareness only:
   a) multi-meters, digital and analogue - voltmeters, ammeters, ohmmeters, diode checkers
   b) continuity testers and circuit tester test lights
   c) battery chargers and battery load testers
   d) ignition spark tester, ignition igniter box testers, ignition dynamic coil testers
   e) inductive tachometers and inductive high amperage pick ups

C. Parts Cleaning Tools ..... 2 Hours

Outcome: ***Demonstrate the correct use of cleaning tools and materials.***

1. Describe the procedures for the safe use of the following engine component cleaning tools:
   a) solvent tank
   b) chemical gasket stripper and gasket scrapers
   c) cold soak and caustic solutions
   d) wire wheels, wire hand brushes
   e) glass bead or crushed walnut shell dry blasting

D. Measuring Tools ..... 9 Hours

Outcome: ***Demonstrate the correct use of measuring tools common to the trade.***

1. Measure components using the following measuring tools:
   a) machinist ruler, straight edge, tape measure
   b) micrometers – outside, inside and depth type
   c) sliding caliper – digital or dial
   d) dial indicators
   e) telescoping and small hole gauges
   f) feeler gauges and thickness go no go gauges
   g) torque wrench and spring scales
   h) plasti-gauge
2. Perform calculation related to measurement using metric and imperial units.
3. Perform linear measurements using basic measuring tools.
4. Perform linear measurements to specified tolerances using precision measuring tools.
5. Perform accurate torque measurements using torque wrench or spring scale.

E. Engine Service and Overhaul Equipment .....1 Hour

Outcome: ***Describe the safe use of and identify engine service and overhaul equipment.***

1. Describe the following engine services using the following tools – awareness only:
   a) engine stands and engine removal hoists
   b) valve and valve refinishing equipment, valve spring testers
   c) cylinder surface refinishing tools, piston ring expanders
   d) stethoscope
   e) pullers, holding devices, bushing and seal installation tools
   f) crankcase leak tester, compression gauge, four stroke cylinder leak down tester, vacuum gauge

F. Engine Tune-up and Service Tools.....1 Hour

Outcome: ***Describe the safe use of and identify engine tune-up and service tools.***

1. Identify and describe the use of special service tools as designated by individual factory service manuals.
2. Describe the use and identify the following tune-up tools (awareness only):
   a) carburetor synchronization vacuum gauges and adjustment wrenches
   b) carburetor float level and fuel level gauges
   c) fuel injection system fuel pressure gauges
   d) valve clearance measurement and adjustment tools
   e) inductive ignition timing lights and spark testers
   f) computerized scan tools and computer interface tools

G. Wheel, Suspension and Frame Service Tools .....1 Hour

Outcome: ***Describe the safe use of and identify wheel, suspension and frame service tools.***

1. Describe and identify wheel, suspension and frame tools:
   a) tire pressure gauges
   b) valve core tool
   c) chain breaker and chain master link rivet tool
   d) air fork and air shock hand pump with no loss gauge
   e) spoke wheel truing equipment
   f) tire changing and balancing tools
   g) frame and wheel alignment tools

H. Power Hand Tools.....3 Hours

Outcome: ***Demonstrate the use and care of power hand tools.***

1. Describe and identify the use of and perform daily maintenance to power hand tools:
   a) electric - impact wrench, rotary grinders and drills
   b) air - impact wrenches, air ratchets, air drills, air die grinders, air hammers

I. General Shop Equipment ..... 6 Hours

Outcome: ***Demonstrate the use and maintenance of general shop equipment.***

1. Identify, use and perform the maintenance to the following general shop equipment:
   a) air compressor location and draining– regulators, air driers, lines, couplings
   b) wet/dry vacuum - filters
   c) heating equipment - propane torch, oxy-fuel torch, hot air gun
   d) jacks - screw type mechanical, hydraulic
   e) industrial oven, hot plates, hot air gun and freezer
   f) battery charging stations or rooms

SECTION THREE: ..... BASIC ELECTRICAL THEORY AND CIRCUITS ..... 30 HOURS

A. Introduction to Electrical Theory and Multi-meter Usage ..... 9 Hours

Outcome: ***Apply scientific principles to explain electrical theory and perform simple meter tests to verify electrical principles in simple circuits.***

1. Explain electrical nomenclature.
2. Define and perform Ohm's law calculations.
3. Define conductors and insulators.
4. Identify simple series and parallel circuits.
5. Identify shorts, opens and grounds in simple circuits.
6. Define total resistance of resistors in simple series and parallel circuits.
7. Define the power formula (watts) as applied to a simple lighting circuit.
8. Demonstrate the use of an analog voltmeter, ammeter and ohmmeter.
9. Perform the use of a digital voltmeter, ammeter, ohmmeter and diode checker.
10. Perform a voltage drop test on a simple starter motor circuit.
11. Perform a total amperage draw test in a simple lighting circuit.

B. Batteries ..... 6 Hours

Outcome: ***Perform servicing, charging and maintaining batteries while observing safety procedures.***

1. Explain the construction and operation of the lead-acid and absorbed glass matt batteries.
2. Describe personal safety protection required when working with batteries.
3. Perform recommended battery testing and servicing operations for different types of batteries.
4. Describe the commissioning procedure for new absorbed glass matt batteries.
5. Perform specific gravity test on the lead acid type battery.
6. Describe sulphating and procedures to recover batteries from sulphating.
7. Describe proper storage procedures for activated and new batteries.
8. Describe safety and environmental issues for disposal of old batteries.

C. Electrical Circuits.....9 Hours

Outcome: ***Identify electrical circuit types and interpret wiring diagrams to find circuit defects.***

1. Read a schematic and identify the various symbols.
2. Describe the use of common test meters to help pinpoint circuit defects.
3. Identify bulb ratings and test bulb continuity in lighting, warning and brake light circuits.
4. Define a basic manual cancelled turn signal circuit.
5. Define basic single and dual horn circuits.
6. Define a basic single phase full wave charging circuit.
7. Define a basic two circuit electric starter motor circuit.
8. Define a basic single cylinder electronic battery coil ignition circuit.
9. Define the basic neutral and oil pressure indicator circuits.

D. Electrical Wiring and Connectors .....6 Hours

Outcome: ***Test, repair or replace electrical wires and connectors in circuits.***

1. Describe types and uses of solders for electrical repairs to wires or switches.
2. Perform soldering of connectors and wires.
3. Perform insulating bare wires with heat shrink tubing.
4. Describe crimp type connectors and tools to properly install them.
5. Describe multiple plug connector replacement.
6. Determine selection of proper wire gauge for circuit amperage.
7. Perform wire replacement in flexible plastic conduit.
8. Describe selecting fuses or circuit breakers for accessories and loads.

SECTION FOUR: ..... MOTORCYCLE ASSEMBLY AND PRE-DELIVERY ..... 30 HOURS

A. Receiving and Inspecting Crated New Machines .....2 Hours

Outcome: ***Demonstrate safe procedures for offloading crated new machines.***

1. Describe safety procedures used when handling crated units.
2. Describe proper lifting devices to load and unload crated units.

B. Reporting Shipment Damage.....1 Hour

Outcome: ***Identify, record and report all shipping damage immediately.***

1. Inspect incoming shipments and wherever possible:
   a) inspect outer perimeter for obvious visual crate damage
   b) remove damaged crate cover in presence of freight hauler and record internal damage on delivery slip
   c) contact freight hauler's insurance for authorization to accept damaged goods and take pictures
2. Follow assembly manual procedures and report missing, damaged or duplicate parts.

C. Assembly Instructions .....9 Hours

Outcome: ***Describe machine assembly following manufacturer's instructions.***

1. Demonstrate assembling a new bike being careful to:
   a) describe all assembly manual instructions explicitly
   b) perform an inspection for the proper routing of clutch, brake, throttle cables and handlebar wiring

D. Minor Body Part Cosmetic Repairs.....3 Hours

Outcome: ***Perform minor paint damage repairs to clear coat only, remove minor abrasions from plastic windshields and describe the care and cleaning of plated surfaces.***

1. Perform minor paint damage repair to clear coat only.
2. Perform minor abrasion repair to plastic windshields.
3. Describe the care and cleaning of chrome, anodized and polished metal surfaces.

E. Manufacturer's P.D.I. Checklist .....12 Hours

Outcome: ***Perform pre-delivery inspections as per manufacturer's specifications.***

1. Identify manufacturer's policies relating to P.D.I.
2. Perform inspections and follow a pre-delivery inspection checklist for safety standards:
   a) all fluid levels and specific gravity if applicable
   b) battery initial charging or commissioning
   c) drive chain or belt adjustment if applicable
   d) torque wheel axle nuts and all key chassis fasteners
   e) brake and clutch lever free play adjustments
   f) tire and suspension pressures
   g) verify all electrical devices and safety switches operate properly
   h) run the engine and inspect for leaks or abnormal engine sounds
   i) washing and cleaning the unit for final delivery

F. Motorcycle Long Term and Winter Storage .....3 Hours

Outcome: ***Prepare new and used motorcycles or ATVs for periods of storage under varying conditions.***

1. Perform preparation of units for extended period storage in heated or unheated situations:
   a) perform fuel system stabilizing, draining of carburetors and applying rust inhibitors to metal fuel tanks
   b) perform battery preparation or removal and describe monthly maintenance
   c) describe the use of breathable covers and preparation of painted and plated surfaces
   d) describe the considerations for rubber and synthetic components exposed to environmental conditions

SECTION FIVE: BASIC TUNE-UP AND MANUFACTURER'S SCHEDULED SERVICE CHECK .....30 HOURS

A. Air Filters .....3 Hours

Outcome: ***Service air filters and inspect air box.***

1. Identify and know when/how to service the various types of air filters:
   a) identify paper, foam, cotton gauze, and other types of air filters
   b) clean or replace air filters using manufacturer's service methods
   c) inspect air box, ducting, hoses and clamps

B. Basic Carburetor Cleaning and Overhaul .....3 Hours

Outcome: ***Perform a basic cleaning and overhaul on a single carburetor equipped motorcycle.***

1. Describe the effects of improper fuel storage and sediment build up on carburetor operation.
2. Perform the removal procedure for a single carburetor from the motorcycle or ATV.
3. Perform cleaning and overhaul on a single carburetor – slide type or (CV) constant velocity type.
4. Install the overhauled carburetor and perform necessary cable adjustments.

C. Engine Compression, Combustion Chamber and Crankcase Sealing Tests .....6 Hours

Outcome: ***Perform compression, leak-down, and crankcase sealing tests and interpret the test results.***

1. Perform dry and wet compression tests to diagnose engine condition.
2. Perform four stroke engine cylinder leak-down testing to diagnose combustion chamber area sealing.
3. Perform two stroke crankcase pressure and vacuum tests to diagnose seal condition.

D. Basic Engine Tune-Up.....12 Hours

Outcome: ***Perform a basic engine tune up by inspecting or adjusting the ignition timing, valve lash, cam chain, primary chain, and carburetor adjustments.***

1. Perform basic ignition tune-up by:
   a) gap or replace spark plugs
   b) inspect operation of electronic ignition advance
   c) inspect or adjust ignition timing
2. Perform valve clearance adjustment on:
   a) a single cylinder engine using a screw type rocker arm adjuster
   b) a multi-cylinder engine using DOHC with shim over bucket tappets
3. Inspect the camshaft timing marks and inspect or adjust the cam chain tensioning system.
4. Demonstrate primary chain adjustment procedures and inspect the lubricant level.
5. Perform necessary adjustments and synchronization to multi-bank carburetors.
6. Perform engine start up, listen for normal engine sounds and observe engine for coolant or oil leaks.

E. Manufacturer's Scheduled Service .....6 Hours

Outcome: ***Describe similarities in manufacturer's scheduled 1st and 2nd service checks and perform common inspections and adjustments specified in service manuals.***

1. Identify manufacturer's time or mileage intervals for schedule maintenance.
2. Describe common service procedures to be performed at 1st and 2nd service checks.
3. Perform control cable inspections, adjustments and lubrication.
4. Perform final drive belt adjustment or final drive chain lubrication and adjustment.
5. Perform inspections of all fluid levels and change any indicated in the service manual, including filters.
6. Describe an inspection of suspension operation and perform air, spring and dampening adjustments.
7. Perform an inspection to tires and adjust air pressures for operating loads.
8. Perform an operational check of all electrical systems and verify all warning and safety switches function.
9. Torque all key fasteners to specification and verify all body parts are properly secured.
10. Describe the test ride procedure, safety, ethics and evaluation of the operation of all systems.

SECTION SIX: .....ENGINE THEORY OF 2 AND 4 STROKE ENGINES.....30 HOURS

A. Two Stroke Engine Operating Principles .....6 Hours

Outcome: ***Explain the operating principles of the simple piston port type, rotary valve type, and reed valve type intake induction two stroke internal combustion engines.***

1. Define the following basics of two stroke engine operating principles.
   a) theory of operation of a piston port intake induction two stroke using loop scavenging principles
   b) exhaust system design and effects on combustion chamber scavenging
   c) theory of operation of a rotary valve intake induction two stroke engine
   d) theory of operation of a cylinder reed valve equipped two stroke engine
   e) theory of operation of a case reed valve equipped two stroke engine
   f) variable exhaust port timing – exhaust power valves, mechanical, electrical and pressure controlled
   g) transfer cutouts (piston and cylinder), transfer port design, timing and variations
   h) port timing – symmetric and asymmetric - effects of altering intake and exhaust durations
   i) squish bands – purpose, minimum and maximum limits, measuring methods used
   j) secondary compression ratios – calculating corrected ratios, effects and methods of altering ratios
   k) primary compression pressure and its effects on the transfer process
   l) fuel oil mixtures requirements and calculating mixture ratios for intended applications

B. Two Stroke Engine Construction and Component Design .....3 Hours

Outcome: ***Describe the construction of the two stroke bottom end and top end components and identify the methods used to seal the joint surfaces.***

1. Describe two stroke engine construction, component design and materials used:
   a) crankcase sealing – methods used on single and multi-cylinder engines
   b) pressure and vacuum testing crankshaft seals and engine gasket joint surface integrity
   c) single and multi-cylinder engine crankshaft configurations and crankcase designs
   d) piston, ring, clip, pin and bearing - design, construction, materials and application
   e) types of cylinder construction and materials used, inspection and repair methods
   f) gaskets – head, base, exhaust and intake – materials and construction

C. Slide Type and Constant Velocity Type Carburetor Theory .....6 Hours

Outcome: ***Explain the operating principles and design features of the slide type and the constant velocity type carburetors.***

1. Describe the basic principals of air pressure, air speed and atomization as it relates to a carburetor's operation.
2. Describe the individual fuel systems and their interrelationship in the round slide type carburetor.
3. Describe the similarities and additional compensating circuits found in the flat slide type carburetor.
4. Describe the basic operation of the constant velocity carburetor and its fuel and air circuits.
5. Describe the differences between the piston type and diaphragm type constant velocity carburetor.

D. Four Stroke Engine Operating Principles .....9 Hours

Outcome: ***Explain the operating principles of the OHV, SOHC, DOHC and DESMO type variations in the valve-train type for four stroke engines.***

1. Define the following basics of four stroke engine operating principles:
   a) theory of operation of a four stroke engine using a basic single cylinder overhead valve design
   b) OHV – overhead valve train nomenclature, design and current applications
   c) SOHC - single overhead camshaft valve train nomenclature and current applications
   d) DOHC - double overhead camshaft valve train nomenclature and current applications
   e) DOHC - variations to valve lash adjustment methods used
   f) DESMO - desmodromic valve train nomenclature and current applications
   g) camshaft designs, camshaft driving systems and adjustment devices
   h) OEM camshaft timing methods, inspection and effects that incorrect camshaft timing will have
   i) importance of the valve overlap period and valve opening durations explained
   j) combustion chamber shapes, design, calculating and measuring volumes
   k) compression ratio – calculating compression ratio and determining effects of altering ratios
   l) measuring piston to cylinder head clearance and observing minimum clearances

E. Four Stroke Engine Construction and Component Design.....6 Hours

Outcome: ***Describe the construction of the four stroke bottom end and top end components and identify parts used in the different types of valve trains.***

1. Describe four stroke engine construction, component design and materials used:
   - a) single and multi-cylinder engine crankshaft and crankcase configurations used
   - b) cylinder construction, design, materials, inspection and repair methods
   - c) piston, ring, pin and clip - design, construction, materials, applications
   - d) connecting rod small end construction and manufacturing methods
   - e) valves, valve springs, valve keepers, spring retainers, spring collars
   - f) valve guides and valve guide seals
   - g) camshafts, camshaft sprockets, tappets, hydraulic lifters, pushrods, rocker arms and cam followers
   - h) cam chain, cam chain tensioners, cam chain guides
   - i) cylinder heads and combustion chambers
   - j) head gasket, base gasket and valve cover gasket design, materials and construction

SECTION SEVEN: .....WHEEL AND TIRE MAINTENANCE .....30 HOURS

A. Types of Wheels.....1 Hour

Outcome: ***Describe common wheel type identification and construction designs.***

1. Identify the types of wheels used on motorcycles and approved DOT indicators:
   - a) wire spoke wheels – 36 & 40 spoke common wheels
   - b) cast wheels – 3 – 8 spoke common wheels and alloy disc type wheels
   - c) stamped wheels – steel disc type wheels and multi piece alloy rim and stamped steel spokes
2. Describe and identify custom wheels used for display only and not safe or legal for road use (awareness only).

B. Wheel Inspection .....2 Hours

Outcome: ***Perform front and rear wheel assembly inspections and measurements.***

1. Perform a proper wheel inspection including:
   - a) inspect for damaged or worn bearings, dust seals and wheel spacers
   - b) inspect wheel and hub for dents, cracks, damaged threads and corrosion
   - c) inspect for bent, broken, or loose spokes
   - d) measure rim lateral and radial run out and rim to hub offset
   - e) describe problems with straightened or refinished cast alloy wheel assemblies
   - f) describe powder coat surface refinishing and inspect for hidden cast alloy wheel damage

C. Wheel Servicing and Overhaul .....15 Hours

Outcome: ***Perform wheel overhauls and servicing.***

1. Perform complete wheel servicing including the following:
   - a) demonstrate the removal and replacement of various wheel bearings
   - b) describe the method of cleaning and checking for damaged or worn bearings
   - c) demonstrate applying wheel bearing lubricants and describe the compatibility of greases
   - d) describe tapered wheel bearing running clearance inspection and adjustment
   - e) perform wire spoke wheel rim run-out measurements
   - f) perform wire spoke tension adjustment to correct wheel rim run-out to specifications
   - g) demonstrate the procedures for replacing a wire spoke wheel rim on a common symmetrical wheel
   - h) describe the procedure for replacing a wire spoke wheel on a conical hub wheel
   - i) perform the replacement of a wire spoke wheel rim and the truing operation to specifications

D. Tire Construction and Repair .....3 Hours

Outcome: ***Identify tire application and explain tire construction.***

1. Identify tire application, sizes, designs and compatibility.
2. Identify manufacturers' and shop policies for tire replacement or repairs.
3. Describe the use of liability release forms and tire disclaimers for non-OEM selections or repairs.

E. Tire Mounting and Dismounting.....9 Hours

Outcome: ***Perform a tire service and inspect for defects.***

1. Service tires properly by:
   - a) dismounting - use of tire irons, manual and pneumatic tire changing machines
   - b) perform tire and rim inspection for
     - i) punctures, cracks and foreign material
     - ii) uneven tread wear, scalloping, knob damage
     - iii) previous repairs, use of flat proof liquids or liquid tire balancing fluids
     - iv) damaged beading area, bead sealing compounds, bead leaks
     - v) proper tire to rim compatibility and application
     - vi) rim bead flange damages, rim tape and protruding spokes
   - c) perform a flat tire repair by replacing a tube or installing an approved patch/plug for a tubeless tire
   - d) perform tire mounting observing directional indication if applicable, air pressures and personal safety
   - e) describe use of a bead lock tire to rim securing device
   - f) perform tire balancing procedure using static and spin balancing methods
   - g) perform wheel installations onto the front and rear of a motorcycle following manufacturer's procedures
   - h) describe hazards associated with tire manufacturing mold release compounds

SECTION EIGHT:..... MECHANICAL AND HYDRAULIC BRAKE SYSTEMS .....30 HOURS

A. Nomenclature .....2 Hours

Outcome: ***Identify terms and components that are used in braking systems.***

1. Identify the names and location of parts used in motorcycle and ATV brake systems:
   a) mechanical drum and disc systems
   b) hydraulic drum and disc systems
   c) anti-lock brake system (awareness only)
   d) integrated and linked hydraulic brake systems

B. Hydraulic Brakes Theory.....2 Hours

Outcome: ***Discuss scientific principles as they are applied to braking operations.***

1. Explain Pascal's law as it applies to a brake fluid in a hydraulic brake system.
2. Describe hydraulic and mechanical pressures as applied in a multi-piston brake calliper system.
3. Name the types of brake fluids and describe their limitations:
   a) fluid and seal compatibility
4. Explain brake fluid's hygroscopic tendency and the result it has on the brake system.

C. Brake Design .....2 Hours

Outcome: ***Explain the operation of drum and disc brake systems.***

1. Describe the operation of the following brake designs:
   a) drum brake - single leading shoe type
   b) disc brakes - external types using hub or rim mounted discs

D. Brake Inspection, Maintenance and Service.....9 Hours

Outcome: ***Service drum brake and disc brake systems.***

1. Inspect, maintain and repair brakes as follows:
   a) drum brakes – hydraulic (ATV) and mechanical
      i) inspect brake levers, lever pivots, pedal mounting and return springs
      ii) inspect brake cables, rods, clevises and linkages
      iii) inspect brake light switches and perform adjustment
      iv) inspect brake cam, arm, spindle and backing plate
      v) inspect torque arm and mounts
      vi) perform cleaning procedures using approved cleaners
      vii) inspect shoe friction material and measure thickness
      viii) inspect drum for cracks and measure drum for wear
      ix) inspect hydraulic wheel cylinders for leaks and perform adjustments
      x) reassemble drum brake internal components using approved procedures

b) disc brakes – mechanical (ATV) and hydraulic
   i) inspect caliper mounting brackets, pivot pins and dust seals
   ii) inspect master cylinder linkages, levers and pivot pins
   iii) inspect rear brake torque arm and mounts
   iv) inspect wheel bearings and dust seals
   v) inspect and adjust brake light switches
   vi) inspect brake pad thickness, wear and friction material to disc compatibility
   vii) measure brake disc thickness, run out and inspect disc surface
   viii) perform brake pad replacement or cleaning
   ix) inspect brake hoses or brake lines and determine if replacement is required
   x) inspect brake fluid for contamination, age, level, and system compatibility

E. Inspecting Brake Hoses and Bleeding Brake Fluid.....6 Hours

Outcome: ***Perform hose inspections or replacements and bleeding procedures on hydraulic systems.***

1. Inspect or change brake hoses using DOT approved lines and fittings when required.
2. Demonstrate the proper procedure to bleed brake systems using conventional and alternative methods.
3. Describe the use, application and liabilities involved with aftermarket hydraulic brake lines and fittings.

F. Master Cylinder, Caliper and Wheel Cylinder Rebuilding .....9 Hours

Outcome: ***Overhaul the hydraulic components in various motorcycle and ATV braking systems.***

1. Rebuild the following hydraulic brake cylinders:
   a) master cylinders – front and rear
      i) remove and dismantle
      ii) clean and inspect all parts
      iii) measure piston and bore for wear, measure return spring free length
      iv) replace all seals, dust boots, cups and internal parts as required
      v) assemble new parts using approved lubricants and service procedures
   b) calipers – front and rear, single or dual piston floating, multi-piston opposed
      i) remove and dismantle
      ii) clean and inspect all parts
      iii) measure piston and bore for wear
      iv) replace all seals, dust boots and internal parts as required
      v) assemble new parts using approved lubricants and service procedures
   c) wheel cylinders – ATV
      i) remove and dismantle
      ii) clean and inspect all parts
      iii) observe piston and cylinder for leakage and measure for wear
      iv) replace seals and dust boots or install complete new wheel cylinder assemblies
      v) assemble new parts or components using approved lubricants and service procedures

SECOND PERIOD TECHNICAL TRAINING
MOTORCYCLE MECHANIC TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:..... CHARGING AND STARTING SYSTEMS ..... 60 HOURS

A. Fundamentals of Electrical Theory Reviewed .....3 Hours

Outcome: ***Describe the theory of electricity using Ohm's law, resistance in series and parallel circuits, power formula, the measurement of volts, ohms and amps using digital multi-meters and high current shunt adapters.***

1. Describe the interrelationship of volts, ohms and amps using simple circuits and Ohm's law.
2. Describe the effects of multiple resistances in parallel and series circuits and apply this to stator windings.
3. Describe the use of the power formula to calculate electrical power used by lights and starter motors.
4. Describe the proper use and circuit connections for measuring volts, ohms, amps with a digital multi-meter.
5. Demonstrate the use of DC high current inductive pick ups and high current shunts.
6. Describe a simple charging system using a schematic diagram and schematic symbols to interpret the function of alternators, rectifiers and a solid state regulator.
7. Describe the use of voltage drop tests to determine circuit connector faults.

B. Charging Systems Diagnostic Tests .....3 Hours

Outcome: ***Perform charging system common diagnostic tests to verify that components function properly and describe normal values for motorcycles and ATVs.***

1. Perform battery load test procedures and describe variances used for different types of motorcycle batteries.
2. Perform the parasitic draw test used for determining current consumption by electrical accessories.
3. Perform the system normal current draw test and describe reasons for possible variance.
4. Perform the system maximum output test and describe manufacture's specifications.
5. Perform the charging system break-even idle rpm test and describe adjustments required.
6. Perform stator AC voltage output tests.
7. Describe procedures or tests used to determine if intermittent charging system failures are occurring.

C. Alternating Current Generators (Alternators) Theory ..... 9 Hours

Outcome: ***Describe the theory of operation of alternating current generators (alternators), the rectification of AC to DC current and the regulation of voltage in a motorcycle or ATV charging system.***

1. Describe motorcycle AC generator (alternator) systems theory of operation:
   a) describe the theory of operation of a permanent magnet single phase full wave rectified systems
   b) describe the theory of operation of a permanent magnet three phase full wave rectified systems
   c) describe the theory of operation of an electromagnetic rotor three phase full wave rectified systems
   d) describe the theory operation of various electronic regulation systems being used
2. Identify schematic symbols and trace charging circuits using manufacturer's wiring diagrams.
3. Describe differences in electrical values for various stators based on methods used for orientating coil windings.
4. Describe the electrical test meters required for bench testing charging system components.
5. Identify the location of charging system components on the motorcycle.
6. Describe the removal and installation of stators, rotors and associated wiring using special puller tools.

D. Single Phase Alternating Current Generators (Alternators) ..... 6 Hours

Outcome: ***Identify the components of a single phase alternator; perform the diagnostic tests and service procedures to verify proper battery charging and system outputs.***

1. Identify the type of charging system stator windings and rated current output from service literature.
2. Perform a charging system voltage test and describe proper charging and regulator operation.
3. Perform an AC output voltage test on unloaded stator windings and describe normal values.
4. Perform stator winding tests, describe the typical values and determine causes for variances.
5. Perform the rectifier diode tests using a digital multi-meter and describe normal values.
6. Perform a total system output test and verify output is within specification.
7. Describe rotor magnet strength and determine signs of weakness.
8. Perform the idle rpm break even charging current test to verify accessories loads are compatible.

E. Three Phase Permanent Magnet Alternating Current Generators (Alternators)..... 6 Hours

Outcome: ***Identify the components of a three phase alternator; perform the diagnostic tests and service procedures to verify proper battery charging and system outputs.***

1. Identify the type of charging system stator windings being used from service wiring diagrams.
2. Perform a charging system voltage test and describe proper charging and regulator operation.
3. Perform an AC output voltage test on unloaded stator windings and describe normal values.
4. Perform stator winding tests, describe the typical values and determine causes for variances.
5. Perform the rectifier diode tests using a digital multi-meter and describe normal values.
6. Describe rotor magnet strength and determine signs of weakness.
7. Perform the idle rpm break even charging current test to verify accessory loads are compatible.

F. Three Phase Electromagnet Alternating Current Generators (Alternators)..... 3 Hours

Outcome: ***Identify the components of a three phase electromagnetic alternator; perform the diagnostic tests and service procedures to verify proper battery charging and system outputs.***

1. Identify the type of charging system stator windings and field coil being used from service wiring diagrams.
2. Perform a charging system voltage test and describe proper charging and regulator operation.
3. Perform an AC output voltage test on unloaded stator windings and describe normal values.
4. Perform stator winding tests, describe the typical values and determine causes for variances.
5. Perform field coil winding resistance, ground tests, verify slip ring condition and brush length.
6. Perform the rectifier diode tests using a digital multi-meter and describe normal values.
7. Perform the idle rpm break even charging current test to verify accessory loads are compatible.

G. Flywheel Magneto AC Lighting Systems ..... 6 Hours

Outcome: ***Service and explain the operational characteristics of flywheel magneto AC lighting systems being used on off road motorcycles and ATV's.***

1. Describe the theory of operation of the flywheel magneto AC lighting system.
2. Identify the AC lighting system components and demonstrate flywheel removal and installation.
3. Perform AC lightning coil resistance measurements and describe manufacturer's specifications.
4. Perform AC voltage tests and describe system voltage overload protection.
5. Discuss aftermarket lighting coil rewinding and system voltage protection.

H. 2- Circuit Electric Starting Systems..... 12 Hours

Outcome: ***Service and explain the operational characteristics of motorcycle and ATV electric starter motor systems that use a low current and a high current circuit for operation.***

1. Describe the theory of operation of an electric start system using two individual current circuits.
2. Identify the two current starter system using manufacturer's wiring diagrams and schematic symbols.
3. Perform continuity tests to an electric starter system switches and wiring.

4. Describe the use of voltage drop tests to determine starter relay contact and starter motor ground problems.
5. Describe the use of a digital multi-meter high DC current inductive pick up or suitable shunt for current draw tests.
6. Perform a bench test to a starter relay (solenoid) and identify operational problems.
7. Perform a disassembly and inspection of a field coil type starter motor.
8. Perform a disassembly and inspection of a permanent magnet type starter motor.
9. Perform armature inspection and test for continuity, shorts and grounded conditions.
10. Measure starter motor brush lengths and describe replacement procedures.
11. Perform starter motor free running and loaded amperage draw tests and interpret readings.
12. Describe starter motor free running clutch systems and explain their operation.
13. Perform starter motor removal, inspection and installation on a motorcycle or ATV.
14. Describe the operation of electric starter motor safety interlock systems.
15. Identify safety interlock systems using manufacturer's wiring diagrams.
16. Perform operational inspections to starter motor safety interlock systems.

I. 3-Circuit Electric Starting Systems.....12 Hours

Outcome: ***Service and explain the operational characteristics of motorcycle electric starter motor systems that use a low current, medium current and a high current circuit for operation.***

1. Describe the theory of operation of an electric start system using three individual current circuits.
2. Identify the three circuit starter system using manufacturer's wiring diagrams and schematic symbols.
3. Perform continuity tests to an electric starter system switches and wiring.
4. Describe the operation of a five terminal relay used in the electric starter system.
5. Describe the use of voltage drop tests to determine starter solenoid contact and starter motor ground problems.
6. Describe the use of a digital multi-meter high DC current inductive pick up or suitable shunt for current draw tests.
7. Perform a bench test to a starter motors hold in and pull in coils.
8. Describe starter motor free running clutch systems and explain their operation.
9. Perform a bench test to the solenoid and inspect the operation of the free running clutch.
10. Perform a disassembly and inspection of starter motor, solenoid and clutch.
11. Perform armature inspection and test for continuity, shorts and grounded conditions.
12. Measure starter motor brush lengths and describe replacement procedures.
13. Perform starter motor free running and loaded amperage draw tests and interpret readings.
14. Describe starter motor removal, inspection and installation on a cruiser type motorcycle.

SECTION TWO:.....TWO STROKE ENGINE TOP END RECONDITIONING..... 45 HOURS

A. Cleaning the Vehicle for Top End Service .....1 Hour

Outcome: ***Describe vehicle preparation for cleaning and perform vehicle cleaning for top end service.***

1. Describe vehicle preparations and the precautions to use with a high pressure hot water washer.
2. Describe cleaning agents, degreasers and procedures for cleaning the vehicle in preparation for top end reconditioning.

B. Diagnostic Testing The Engine Condition .....5 Hours

Outcome: ***Perform diagnostic procedures used to evaluate engine condition and pinpoint problems.***

1. Describe the test equipment and the procedures used to diagnose engine problems.
2. Perform an engine sounds test using a mechanic's stethoscope or alternative.
3. Perform a cranking compression dry and wet test.
4. Perform the two stroke engine crankcase pressure and vacuum tests.
5. Discuss the cylinder pressure leak down test.
6. Describe a computer controlled rear wheel dynamometer test procedure.

C. Cylinder Head Removal, Cleaning, Inspection, and Repair .....9 Hours

Outcome: ***Perform the removal of the cylinder head and describe the cleaning, inspecting, measuring and repairing any defects related to the cylinder head.***

1. Perform removal of the cylinder head and any related components observing fastener patterns.
2. Describe cylinder head design and construction, related components and their operation.
3. Inspect for defects; cracks, warped mating surfaces, obstructed cooling passages, blown gaskets, and others.
4. Describe problems associated with excessive carbon deposits on cylinder heads and removal methods.
5. Describe head gasket design, service and identify correct installation direction.
6. Describe the use of engine cleaning chemicals or solvents on the cylinder head.
7. Describe resurfacing techniques to repair the cylinder head and the limits before replacement is required.
8. Perform measurement on the piston to cylinder head squish band clearance using modern methods.
9. Perform measurement of the combustion chamber volume and calculate a corrected compression ratio.
10. Perform the torque procedures and patterns required to install a serviced cylinder head.

D. Cylinder, Pistons, Rings, Power Valves and Reed Cage Servicing ..... 18 Hours

Outcome: ***Service cylinders, pistons, rings, reed valves, rotary valve and exhaust power valves.***

1. Describe cylinder construction; materials, manufacturing methods, finishes, port shapes, locations, etc.
2. Describe cylinder base gasket construction, materials and removal methods.
3. Perform an inspection and measurement on all cylinder gasket sealing surfaces.
4. Describe the removal, inspection and measurement of any cylinder reed valve assembly.
5. Describe the servicing of any exhaust power valve assembly and its operating mechanism.
6. Perform a reconditioning of the cylinder surface suitable for measurement or ring replacement sealing.
7. Perform measurement of cylinder internal dimensions and compare to service specifications.
8. Perform a re-sizing of the cylinder bore to accommodate a 0.010 inch or 0.25 mm oversize piston by using the rigid honing process only.
9. Perform a chamfering procedure on all the cylinder port edges.
10. Perform an inspection for specific damage to the piston, piston rings, wrist pin and bearing.
11. Perform all measurements of the piston and piston ring as required in the manufacturers' specifications.
12. Perform the measurement of the connecting rod small end, needle bearing and wrist pin clearances.
13. Perform the measurement of installed and free end gaps on new piston rings before installation.
14. Perform the installation of the piston and cylinder using specific manufacturers' procedures.
15. Describe the clearance, adjustment and timing verification procedures for an exhaust power valve.
16. Describe the procedure used for installation and timing of a rotary valve on a single cylinder engine.

E. Crankshaft Bearings and Crankcase Sealing. ..... 3 Hours

Outcome: ***Describe inspections and measurements used to determine the integrity of the crankshaft bearings and the crankshaft seals.***

1. Perform a visual inspection of the crankshaft connecting rod and shaft tapers for top end related problems.
2. Perform crankshaft bearing clearance measurements:
   a) main bearing radial and axial play
   b) big end bearing radial and connecting rod side clearance
3. Describe variations in crankcase seal design used for multi-cylinder engines.

F. Engine Top End Assembly and Break In ..... 9 Hours

Outcome: ***Assemble all reconditioned top end parts and related components, start the engine and verify no leaks or abnormal sounds are present and proceed to a specified break in procedure.***

1. Perform the assembly procedure of all top end parts and related components.
2. Perform a pressure test on the engine to verify correct assembly of all seals and gaskets.

3. Perform an inspection of the fuel and exhaust system components.
4. Perform an initial start up checking for leaks and abnormal sounds.
5. Describe the break in procedure used during a road test or alternative (rolling chassis dynamometer) including rear tire disclaimers.

SECTION THREE: .....FRAMES AND SUSPENSIONS..... 45 HOURS

A. Frame Design, Construction and Materials .....1 Hour

Outcome: ***Identify common frame designs and frame materials used by different manufactures.***

1. Describe and identify the common types of frames and materials used by motorcycle manufacturers such as:
   a) cradle frames – single down tube and double down tube
   b) backbone frame
   c) stamped frame
   d) perimeter frame

B. Front Suspension Design and Nomenclature .....8 Hours

Outcome: ***Describe the operation and identify various common front suspensions systems and components.***

1. Describe the operating principles of a common hydraulic telescopic front suspension system.
2. Describe and identify these front suspension designs and these specific components:
   a) telescoping forks
      i) fork tubes
      ii) triple tree clamps
      iii) triple tree spindle
      iv) fork sliders
      v) damper systems
      vi) fork seals and dust boots
      vii) spring types
      viii) air assist systems
   b) aftermarket emulator valves (awareness)
   c) leading link suspension systems (awareness)
   d) cartridge – single chamber type only
   e) inverted telescoping forks
   f) springer - OEM only (awareness)

C. Steering Geometry and Wheel Alignments ..... 9 Hours

Outcome: ***Describe steering system geometric principles, their effect on handling and their interrelationship with wheel alignments.***

1. Describe steering neck rake angle, trail distance and triple tree or front axle offset.
2. Describe the normal handling effect of manufacturer's rake, trail and offset specifications.
3. Describe the effects of modifying front end components on rake, trail, offset and handling.
4. Describe and identify steering damper systems.
5. Describe wheel and chassis alignment relationships with vehicle handling and tire wear.
6. Perform an inspection of wheel and chassis alignment using the string method, parallel bar or laser device.
7. Describe the effects of a rear suspension lowering kit on ground clearance and handling.

D. Front Suspension Inspection, Service and Overhaul ..... 15 Hours

Outcome: ***Perform an inspection, service and overhaul of the front suspension systems.***

1. Perform an inspection on the front suspension observing for leaks, wear, damages and misalignments.
2. Perform a front suspension fluid change.
3. Describe motorcycle front suspension fluids and their properties.
4. Perform a fork seal replacement.
5. Perform adjustment of the front suspension air pressure.
6. Perform an overhaul of the front forks, check fork tube run out, replace worn out components and make specified dampening/spring adjustments.
7. Perform a steering head bearing inspection and adjustment according to manufacturer's specifications.
8. Perform the assembly and alignment of all front suspension components overhauled.
9. Describe the verification of routing of all control cables and handlebar wiring during the front end overhaul.

E. Rear Suspension Inspection and Service ..... 9 Hours

Outcome: ***Perform an inspection, service and overhaul of the rear suspension system.***

1. Perform an inspection of the rear suspension observing for leaks, wear, damages and misalignments:
   a) inspect the swing arm and service its bushings or bearings
   b) inspect single shock systems and service the linkages
   c) inspect and adjust dual shock systems
   d) inspect and service refillable OEM single shock units
   e) perform an inspection and adjustment of the nitrogen shock pressure to manufacturer's specifications
   f) describe rear shock spring rates, compression and rebound dampening settings
   g) perform a suspension balance inspections and adjustment

F. Suspension System Air Compressors ..... 3 Hours

Outcome: ***Describe the inspection and service procedures for on board suspension system air compressors.***

1. Describe the operation of a suspension system on board air compressor system.
2. Perform a service to the air drier in an on board air compressor system.
3. Perform the adjustment of front or rear suspension pressures using an on board air compressor system.

SECTION FOUR: ..... FUELS, LUBRICATION AND COOLING SYSTEMS..... 30 HOURS

A. Engine and Gear Oils ..... 3 Hours

Outcome: ***Describe lubricating oil composition, characteristics and properties.***

1. Identify and describe the types and grades of engine oils using API and SAE specifications.
2. Describe oil additives and explain their function.
3. Describe the similarities and differences of motorcycle specific oils.
4. Identify motorcycle manufacturer's lubrication requirements and specified drain periods.
5. Identify and describe the types and grades of gear oils using API and SAE specifications.

B. Lubrication System Performance Tests..... 3 Hours

Outcome: ***Identify motorcycle lubrication system types and perform oil pressure tests according to manufacturer's procedures.***

1. Identify the tools required to perform an oil pressure test.
2. Describe the pressure requirements of different engine types based on crankshaft bearings used.
3. Perform oil pressure testing on medium and high pressure systems observing manufacturer's specifications.
4. Describe oil pressure testing on low pressure systems used on ATVs and off road motorcycles.
5. Describe verification of oil pressure relief valve function.

C. Lubrication System Inspections, Service and Overhaul ..... 6 Hours

Outcome: ***Describe the common components of motorcycle lubrication systems and perform an overhaul on an oil pump.***

1. Describe the different oil pumps and their capabilities of supplying the lubrication system.
2. Describe and identify typical wet and dry sump engine lubrication systems.
3. Describe and identify typical common sump, semi dry sump and dual sump engine lubrication systems.

4. Describe the operation and perform a service to the following filtration systems:
   a) full flow and partial flow filters
   b) centrifugal filters
   c) paper elements – spin on type and cartridge type
   d) mesh screens
   e) oil filter by pass valve operation
5. Describe the function, identify and service the following lubrication circuit valves:
   a) oil pressure relief valves
   b) oil pump bypass valves
   c) oil gallery metering orifices
   d) oil spray jets and nozzles
6. Perform an inspection and overhaul on the following oil pump types:
   a) gear pumps – supply only, supply and return
   b) piston pump – supply only for two stroke engine
   c) rotor pumps – supply only, supply and return

D. 2-Stroke Engine Lubrication.....3 Hours

Outcome: ***Describe the requirements of motorcycle 2-stroke engine lubrication and perform a verification of oil pump output volume.***

1. Describe 2-stroke engine lubrication requirements and methods:
   a) discuss the characteristics of 2-stroke engine oils
   b) discuss premix ratios for manufacturer's specifications and demonstrate calculating oil to gasoline volumes
   c) describe oil injection systems – methods of oil delivery [illegible]stments and bleeding air
   d) perform an oil injection system pump output volume tes[illegible]
   e) describe two stroke engine gearbox and clutch lubrication methods and similarities of lubricants

E. Gasoline and Fuels.....3 Hours

Outcome: ***Describe gasoline composition, precautions, characteristics and properties.***

1. Describe the composition of internal combustion fuels including qualities listed:
   a) describe normal combustion, detonation and pre-ignition
   b) describe octane rating and octane boosters
   c) identify and describe regular, mid-grade and premium pump gasoline
   d) describe oxygenated gasoline compounds and aromatics
   e) describe additional gasoline additives blended by the manufacturer
   f) discuss effects of special purpose non-pump gasoline and alternate fuels for competition use (awareness)
   g) describe storage life and stability improvers for gasoline in the motorcycle
   h) describe safe handling of gasoline and proper storage containers

F. Cooling Systems..... 12 Hours

Outcome: ***Describe the operation and perform the required service to liquid and air cooling systems and their related components.***

1. Describe the physical principles involved in heat transfer.
2. Describe free air radiant cooling, forced air fan cooling, and liquid cooling principles.
3. Describe principles of operation and perform the scheduled service to cooling system components:
   a) inspect water pump seals, impeller blades and shaft bearing condition
   b) identify and perform operational tests to a thermostat
   c) perform a radiator cap pressure test
   d) inspect system hoses, lines and clamps
   e) perform a cooling system pressure test
   f) inspect and test operation of radiator fans and thermo switches
   g) inspect and perform necessary repairs to radiator cooling fins
4. Perform the draining, filling and purging air (bleeding) of a cooling system with a recovery tank.
5. Perform the draining, filling and purging air (bleeding) of a cooling system without a recovery tank.
6. Describe the properties of coolants used in the motorcycle liquid cooling system:
   a) mixing ratios of coolant and distilled water
   b) perform specific gravity tests to determine coolant freeze up protection
   c) identify coolant corrosion problems and manufacturers drain intervals
   d) describe additives and inhibitors in normal and extended drain period type coolants
7. Describe correct procedures for disposing of coolants and the associated hazards in handling coolants.
8. Describe the service requirements for other types of cooling systems such as oil coolers and oil filter coolers.
9. Describe the effects of silicates on water pumps and other cooling system components.

SECTION FIVE: ..... CLUTCH SYSTEMS AND PRIMARY DRIVE SYSTEMS..... 30 HOURS

A. Clutch Release Mechanisms ..... 6 Hours

Outcome: ***Describe the operating characteristics, diagnose problems and perform normal servicing to the various common clutch release systems used on motorcycles.***

1. Describe the operational functions and perform an overhaul to various clutch release mechanisms:
   a) mechanical types – ball and ramp, traverse screw type, rack and pinion, lever and pivot, and cam
   b) hydraulic – master cylinder and external slave cylinder type
   c) perform overhaul and service mechanical clutch release systems
   d) perform an overhaul and bleed the hydraulic clutch release systems

B. Clutch System Nomenclature, Identification and Theory ..... 6 Hours

Outcome: ***Describe the operating characteristics of various common clutch systems used in motorcycle and ATV engines.***

1. Describe the theory of operation of clutch systems such as:
   a) multi-plate wet clutch – outer push type pressure plate
   b) multi-plate wet clutch – inner push type pressure plate
   c) multi-plate wet clutch – one way torque limiting type
   d) multi-plate wet clutch – aftermarket extra plate kit types
   e) multi-plate dry clutch
   f) single plate dry clutch
   g) centrifugally controlled – multi-plate type and drum type
   h) continually variable transmission (CVT) type used in ATVs
   i) torque converter – engine oil fluid type

C. Clutch Disassembly and Overhaul ..... 6 Hours

Outcome: ***Perform an inspection, diagnose problems and perform an overhaul to a common outer push type motorcycle clutch.***

1. Identify and perform a service to clutch system components such as:
   a) fiber plates and friction materials
   b) clutch shoes, friction materials and drums
   c) steel plates and pressure plates
   d) special plates used to smooth engagement problems
   e) hubs and pressure springs
   f) baskets – bearing, bushing, thrust washer and shock absorbing systems
   g) hydraulic assisted pressure plate types (awareness)
   h) torque converter service (awareness)
   i) drive and driven pulleys – ramps, rollers, springs, shoes, drum, belts (awareness)

D. Primary Type Kick-Start Systems ..... 3 Hours

Outcome: ***Describe the operation, identify types and service the common primary type kick-start systems.***

1. Describe the operation of a common primary type kick-start system.
2. Identify the classification of kick-start mechanism used in the primary type kick-start system.
3. Perform a diagnostic procedure and an external inspection of the primary type kick-starter system:
   a) inspect kick start lever, splines and return spring performance
   b) perform diagnostic procedures on kick-starter engagement and engine sounds
4. Perform an inspection of an external crankcase housed primary type kick-start system.

E. External Crankcase Housed Primary Drive Systems.....6 Hours

Outcome: ***Describe external crankcase housed primary drive systems, identify components and perform the service to primary drive systems used on motorcycle and ATV engines. These systems do not require crankcase splitting.***

1. Describe the operation of an external crankcase housed, chain type primary drive system.
2. Identify the components of an external crankcase housed, chain type primary drive system.
3. Perform an inspection and adjustment to an external housed, chain type primary drive system.
4. Describe the operation of an external crankcase housed gear driven type primary drive systems.
5. Identify the components and variations of gear driven type primary drive systems.
6. Perform an inspection and measurement to an external crankcase housed gear driven primary drive system.
7. Describe the theory of operation and service procedures for:
   a) primary drive shock absorbers - compensating sprockets, clutch basket springs or rubbers, jackshaft rubbers
   b) diagnosing constant velocity transmission (CVT) performance and problems
   c) describe calculating a primary drive ratio and the effects of gear reduction
   d) describe modern methods for measuring engine brake torque and calculating horsepower

F. Internal Crankcase Housed Primary Drive Systems.....3 Hours

Outcome: ***Describe internal crankcase housed primary drive systems, identify components and perform the service to primary drive systems used on motorcycle and ATV engines. These systems do require crankcase splitting and the service will be performed in the 4th period training.***

1. Describe the common problems and diagnostic procedures to evaluate the condition of an internal crankcase housed chain type primary drive system.
2. Describe the operation of internal crankcase housed gear driven type primary drive systems.
3. Identify the components of an internal crankcase housed, chain type primary drive system.
4. Perform diagnostic tests to determine defects within an internal crankcase housed gear driven primary drive system.

SECTION SIX: ..... FINAL DRIVES ..... 30 HOURS

A. Roller Chain Final Drives ..... 6 Hours

Outcome: ***Describe the operation, diagnose problems and perform the adjustments and service to motorcycle roller chain final drive systems.***

1. Describe the operation, perform an inspection, adjustment and service to a motorcycle chain final drive:
   - a) street bike, dual purpose and motocross motorcycle chain drive systems
     - i) perform sprocket inspection, service, and describe selection and ratios
     - ii) describe roller chain, design, types, size, designation and wear limits
     - iii) identify lubricants and describe application of roller chain lubricants
     - iv) perform roller chain cleaning, lubrication and adjustments
     - v) describe endless chain removal and replacement
     - vi) perform joint link installation to install aftermarket endless chain
     - vii) describe chain alignment , inspection and adjustment

B. Belt Drive ..... 6 Hours

Outcome: ***Describe the operation, diagnose problems and perform the adjustments and service to motorcycle toothed belt and scooter v-belt final drive systems.***

1. Describe the operation, perform an inspection, adjustment and service to the two types of belt final drive systems:
   - a) street bike toothed belt systems
     - i) perform sprocket inspection and describe sprocket selection and ratios
     - ii) describe belt design, construction, size, wear limits, handling and damages
     - iii) perform belt cleaning, inspection and adjustments
     - iv) describe belt replacement procedures
   - b) scooter v-belt systems
     - i) describe the similarities in scooter primary and final v-belt drive systems
     - ii) describe drive and driven pulley face inspections
     - iii) describe belt design, construction, size, wear limits, handling and damages
     - iv) describe belt cleaning, inspection and adjustments
     - v) describe belt replacement procedures

C. Shaft Drive ..... 9 Hours

Outcome: ***Describe the operation, diagnose problems and perform the adjustments and service to motorcycle and ATV shaft final drive systems.***

1. Describe the operation, perform an inspection and service the shaft drive final drive system:
   - a) motorcycle shaft drive
     - i) describe shaft drive operation and identify shaft drive system components
     - ii) perform an inspection and service of the shaft drive system
     - iii) describe the grease and lubricant used in shaft drive system components
     - iv) perform diagnostic tests and measurements to determine problems with the shaft drive system
     - v) perform an inspection of the propeller shaft and swing arm assembly
     - vi) describe swing alignment and tapered bearing preload procedures
     - vii) describe the rear wheel drive flange to final gear case alignment procedures
   - b) ATV shaft drive
     - i) perform an inspection and overhaul on a shaft drive system final gear-case unit
     - ii) describe final gear-case bearing preload, tooth contact pattern and back-lash
     - iii) describe the operation of splines, couplings, universal joints and cam type dampers
     - iv) describe rear axle bearing inspection and fastener torque

D. ATV Four Wheel Drive Front Differential ..... 6 Hours

Outcome: ***Describe the operation, diagnose problems and perform service to ATV four wheel drive front differential systems.***

1. Describe the operation and perform an inspection and service to ATV front differentials:
   - a) describe the basic differential theory
   - b) describe the operation of a clutch pack type limited slip differential
   - c) perform an inspection to a clutch pack type limited slip differential
   - d) describe the operation of a torque sensitive mechanical type limited slip differential
   - e) perform an inspection to a torque sensitive mechanical type limited slip differential
   - f) describe the operation of a mechanical gear lock-up system in a front wheel differential
   - g) inspect shifter cable adjustment and operation
   - h) describe the removal procedures for front wheel drive shafts
   - i) describe the service procedures for front wheel drive shaft constant velocity joints and boots

E. Final Drive Shock Dampening Systems ..... 3 Hours

Outcome: ***Describe the function, inspect the operation and perform the service to final drive shock dampening systems.***

1. Describe the theory of operation of final drive shock dampening systems.
2. Identify and inspect the chain type final drive rear wheel cush-drive couplings.
3. Identify and inspect propeller shaft cam type damper mechanisms.

THIRD PERIOD TECHNICAL TRAINING
MOTORCYCLE MECHANIC TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:.....4-STROKE ENGINE TOP END DIAGNOSTICS AND ADJUSTMENTS..... 60 HOURS

A. Vehicle Preparation and Cleaning .....1 Hour

Outcome: ***Describe how to prepare and properly clean the motorcycle or ATV for top end disassembly.***

1. Demonstrate how to prepare the unit for pressure washing and perform this procedure.
2. Describe how to safely apply degreasers and solvents used for engine cleaning purposes.
3. Describe special procedures required for cleaning chrome plated, anodized aluminium or painted surfaces.

B. Engine Top End Diagnostic Tests .....5 Hours

Outcome: ***Perform engine diagnostic tests, record data and compare to manufacturer's specifications.***

1. Perform and record a dry compression test and a wet compression test.
2. Perform a cylinder leak down test.
3. Perform an oil pressure test.
4. Perform rear wheel dynamometer testing and evaluations and describe rear tire disclaimers.
5. Perform a fuel pump pressure test.

C. Camshaft Timing Verification and Valve Adjustments SOHC and DOHC Engines .....12 Hours

Outcome: ***Perform engine valve clearance, chain/belt adjustments and inspect camshaft timing.***

1. Describe valve opening/closing theory.
2. Verify camshaft timing using OEM methods.
3. Perform engine valve adjustments on:
   a) SOHC multi-valve engines – screw type adjusters on forked rocker arms
   b) DOHC multi-valve engines – screw type adjusters on forked rocker arms or shim over bucket system
4. Perform cam chain inspection and adjustments on:
   a) manual type chain adjusters
   b) automatic type – inspect for proper operation
   c) measure cam chain wear and inspect sprockets
   d) inspect cam chain guides and/or idler sprockets for wear
5. Perform cam belt adjustments and inspections.

D. Remove and Replace OEM Camshafts ..... 12 Hours

Outcome: ***Perform camshaft inspections, measurements and adjustments to related valve train components.***

1. Demonstrate camshaft removal and replacement procedures for SOHC and DOHC engines using OEM specifications and timing procedures.
2. Inspect and measure camshaft and related components to determine wear and serviceability.
3. Identify common camshaft and follower failures.
4. Perform valve lash adjustments on multi-valve combustion chambers using shim under bucket adjustment.
5. Describe new camshaft set-up and break-in procedures.

E. After Market Camshaft Installation – "Drop-In" Types Only. ..... 12 Hours

Outcome: ***Demonstrate the manufacturer's procedures for installation of after market camshafts and perform the camshaft timing procedure.***

1. Determine cam identification, lobe height, valve lift, and valve opening duration measurements.
2. Describe aftermarket camshaft manufacturer's valve lash recommendations and perform adjustments.
3. Describe aftermarket camshaft sprocket construction, installation and adjustment.
4. Perform the DOHC camshaft timing procedure using the lobe centerline method (LC).
5. Describe flow bench theory and demonstrate a flow test on a cylinder head intake port.
6. Discuss the effect of camshaft lift, duration, valve seat angles and port shape on engine performance.
7. Observe and record a dynamometer evaluation comparison of OEM and after market camshafts and describe the effects on engine performance.

F. Hydraulic Valve Adjustment Systems ..... 12 Hours

Outcome: ***Demonstrate hydraulic valve adjuster inspections or adjustments.***

1. Inspect and adjust valve train components to manufacturer's specifications:
   a) perform OHV (pushrod) engines – inspections, leaks, sounds
   b) demonstrate OHV engine set up with after market adjustable push rods
   c) describe SOHC engines with eccentric rockers – discuss shim adjustment for hydraulic units
   d) describe DOHC engines with rockers – inspection and bleeding hydraulic units

G. Desmodromic Engines ..... 6 Hours

Outcome: ***Describe the theory of operation and demonstrate service adjustments.***

1. Describe the theory of operation of a desmodromic valve train system.
2. Discuss valve lash inspections and adjustments for a 2-valve combustion chamber.
3. Demonstrate valve lash inspection and describe adjustments for a 4-valve combustion chamber.

SECTION TWO: ..... FOUR STROKE TOP END RECONDITIONING ..... 60 HOURS

A. Engine Removal and Chassis Storage ..... 2 Hours

Outcome: ***Describe engine removal including related components and chassis preparation for storage.***

1. Perform fuel system inspection, cleaning, draining and safe storage of fuel.
2. Describe carburetor removal, cleaning, inspection and verify jetting specifications.
3. Perform inspections to the air box, filters, connections and vacuum valve.
4. Perform removal, inspection and storage of the exhaust system.
5. Perform cooling system inspection, drain, and store or dispose coolant.
6. Disconnect, clean and service electrical connectors.
7. Describe inspecting or draining the lubrication and filtration systems.
8. Disconnect, inspect, and store final drive components.
9. Perform removal of the engine mounts and remove engine.
10. Prepare chassis and related components for storage.

B. Engine Top End Disassembly ..... 2 Hours

Outcome: ***Perform engine top end disassembly of components and parts.***

1. Remove valve train components.
2. Remove cylinder head assembly.
3. Remove cylinder assemblies.
4. Remove pistons from connecting rods.
5. Describe removing the bottom crankcase assembly on integrated cylinder/upper crankcase engines only.
6. Demonstrate removing connecting rods and piston assemblies from the crankshaft on integrated cylinder/upper crankcase engines only.

C. Cleaning and Inspections of Top End Components ..... 2 Hours

Outcome: ***Perform cleaning and inspections of top end components.***

1. Solvent or soap wash components and use compressed air to dry.
2. Clean carbon from combustion chambers and pistons, check for cracks.
3. Clean gasket surfaces using a scraper, glass bead blasting or with commercial chemical strippers.
4. Perform fastener identification, inspection, location and clean all threads, repair or replace as necessary.
5. Perform visual inspections of camshaft journals, cylinder head cam bores and all bearing surfaces.
6. Perform visual inspections of cam lobes and cam follower/rocker heels/pads.
7. Inspect all internal cam chain guides, rollers and sprockets.
8. Measure cylinder head and cylinder surfaces for warpage.
9. Perform a deglaze procedure on the cylinder surface using a flex hone.

10. Remove and replace locating dowels as necessary.
11. Perform tagging, bagging and lubrication of cleaned and inspected parts for storage.
12. Perform an inspection and measurement on wrist pin and connecting rod small end surface conditions.
13. Perform an inspection of the connecting rods for bends or twists using the indexing rod method.
14. Perform side clearance measurement of a connecting rod big end and a bearing radial clearance measurement.

D. SOHC and DOHC Cylinder Head Disassembly and Inspections ..... 6 Hours

Outcome: ***Perform cylinder head disassembly, inspections and measurements.***

1. Organize and label components by location.
2. Measure, record and compare combustion chamber volume to specifications.
3. Remove rocker shafts and arms and measure clearances to determine wear.
4. Remove tappets (bucket and shim) and measure bucket to cylinder head bore clearances.
5. Remove, clean and inspect valve keepers, springs, valves and seats.
6. Perform valve and guide cleaning, check for cracks and measure stem to guide clearance.
7. Demonstrate cleaning carbon from the valve seat and the cylinder head port.
8. Perform and record valve stem protrusion measurement.
9. Perform camshaft journal to cam bore clearance measurement using the plasti-gauge method.
10. Perform valve spring measurements, free length, installed height, distortion and pressure checks.
11. Demonstrate hydraulic valve lash adjuster inspections, bleeding and record shimming.

E. OHV (Pushrod) Cylinder Head Disassembly and Inspection ..... 3 Hours

Outcome: ***Describe cylinder head disassembly, inspection and service procedures.***

1. Describe rocker arm bushing replacement and perform rocker bore to shaft clearance measurements.
2. Perform installed valve spring height measurements.
3. Perform an inspection of the valves, keepers, springs, collars, retainers and seals.
4. Describe measuring all components for wear or damage.
5. Perform and record valve stem protrusion.
6. Perform measurement of valve stem to guide clearances.
7. Describe valve guide removal, installation and sizing procedures.
8. Describe calculating valve head separation distances for cam lifts.

F. OHV (Pushrod) Engine Gear Case/Camshaft Inspection and Service ..... 6 Hours

Outcome: ***Demonstrate engine gear case inspections and camshaft fitment.***

1. Describe removing hydraulic tappets and tappet block.
2. Demonstrate inspecting hydraulic tappets and perform storage procedure.
3. Demonstrate measuring camshaft end play and gear backlash.
4. Perform camshaft inspection and breather gear for wear.

5. Demonstrate camshaft needle bearing and bushing replacements.
6. Perform breather gear shimming and pinion shaft run-out measurements.
7. Demonstrate fitment of cam gear and pinion gear for specified gear backlash.
8. Describe oil pump inspection procedure.
9. Demonstrate reassembly of the gear case and adjustment of the valve train.

G. Recondition Valves, Valve Seats and Valve Guides ..... 12 Hours

Outcome: ***Describe reconditioning procedures for heads, valve and guides, and perform inspections and minor reconditioning procedures.***

1. Describe valve guide removal and installation methods.
2. Perform valve guide inspection, cleaning and ream to size.
3. Demonstrate cutting valve seats using multiple angles.
4. Demonstrate resurfacing valve face and tip to repair minor damage.
5. Perform valve to seat contact check and lapping of valve seats when required.
6. Describe valve and seat materials, construction and identification.
7. Describe valve seat replacement and availability from OEM and aftermarket.
8. Perform reassembly of the cylinder head components using specified lubricants and procedures.

H. Inspection of Cylinders, Pistons, Rings, Pins and Clips ..... 6 Hours

Outcome: ***Inspect and measure cylinders, pistons, rings, pins and clips; determine serviceability.***

1. Describe cylinder types, construction and coatings.
2. Perform cylinder measurements, describe tolerances and wear limits.
3. Describe piston construction, types, alloys and coatings.
4. Perform piston measurements and cleaning.
5. Describe piston orientation, offset wrist pins and directions.
6. Describe piston ring construction, coatings and locations.
7. Perform piston ring measurement for wear and installation clearances.
8. Perform new piston ring installation and describe locations and directions.
9. Describe wrist pin construction, perform measurements and installation.
10. Describe wrist pin circlip types, installation, construction and location.
11. Calculate piston to cylinder clearances using OEM and after-market piston manufacturing specifications.
12. Describe assembly lubricants and their applications.

I. Cylinder Reconditioning ..... 6 Hours

Outcome: ***Demonstrate reconditioning procedures for cylinders.***

1. Perform cylinder surface preparation using various hones and grits compatible with piston rings.
2. Perform rigid honing and power honing of a cylinder.
3. Describe the use of torque plates.

4. Observe a demonstration on boring a cylinder.
5. Discuss and view a demonstration for installing a cylinder sleeve, pressed in type only.
6. Describe repairing coated bores and take part in a discussion of the process used.
7. Perform inspections and measurements to cylinder deck and base surfaces.
8. Demonstrate the safe use of the lathe for minor machining purposes, such as trimming a cylinder sleeve.

J. Connecting Rod Small End Inspections and Reconditioning ..... 3 Hours

Outcome: ***Describe service procedures and perform measurements to the connecting rods.***

1. Perform small end measuring and inspection for wear and failures.
2. Describe the use of indexing rods and alternate methods to check for connecting rod trueness.
3. Describe replacing pressed in bushings to resize small ends of the connecting rod.

K. Servicing of Integrated Cylinders and Crankcase Assemblies ..... 3 Hours

Outcome: ***Describe service removal and repair procedures for engines using an integrated cylinder and upper crankcase assembly.***

1. Describe removal of the bottom crankcase assembly.
2. Describe connecting rod disassembly and removal of the piston/rod assembly from the cylinder block.
3. Describe when crankshaft removal may be necessary from the upper case.
4. Perform cleaning, deglazing, measuring and inspecting the cylinder bore and piston assembly.

L. Top End Assembly and Engine Installation ..... 6 Hours

Outcome: ***Perform top end assembly and install engine and ancillary parts.***

1. Determine pre-assembly lubricants for components and quantities to be used.
2. Perform base gasket and locating dowel installation.
3. Perform installing cylinder studs and nuts using prescribed torque procedure and pattern.
4. Describe head gasket construction and perform installation procedures.
5. Perform cylinder head installation and torque to specifications using proper patterns and procedures.
6. Perform the final assembly of the valve train.
7. Perform engine installation into the chassis and install all ancillary parts.

M. Initial Start Up, Break-in and Dynamometer Evaluation ..... 3 Hours

Outcome: ***Perform start up and break- in procedure, and perform a dynamometer evaluation.***

1. Perform cranking the engine and check for oil circulation.
2. Perform starting the engine and check for start up leaks.
3. Perform running the engine under partial load continually varying the rpm and listen for abnormal engine sounds.
4. Perform heat cycling the engine for initial break-in.
5. Perform running the engine on a dynamometer and compare results.
6. Describe specified break-in procedures, re-adjustment requirements and customer communications.

SECTION THREE: ..... IGNITION SYSTEMS AND SAFETY INTERLOCKS..... 60 HOURS

A. Ignition System Fundamentals ..... 2 Hours

Outcome: ***Describe the theory of operation of a basic ignition system and demonstrate the use of wiring diagrams to explain the normal electrical values expected at test points in the ignition circuit.***

1. Identify the basic components of a simple 12 volt battery, coil and electronic triggered motorcycle ignition system.
2. Describe the operation of the Darlington generator and the Hall integrated circuit electronic triggering devices.
3. Demonstrate the use of manufacture's wiring diagrams to describe current and voltages in the ignition circuit.

B. Ignition System Service Tools and Diagnostic Equipment..... 4 Hours

Outcome: ***Demonstrate the use of tools and test equipment to perform ignition system service and diagnosis.***

1. Describe the methods used to verify flywheel or rotor ignition timing marks on a 2-stroke engine.
2. Perform a dynamic ignition timing inspection using an inductive pick up type timing light.
3. Demonstrate the use of an inductive tachometer to verify engine rpm.
4. Demonstrate the use of peak voltage adaptor and a digital multi-meter.
5. Demonstrate the use of an ignition system spark tester.
6. Demonstrate the use of an ignition coil dynamic spark tester.
7. Demonstrate the use of ignition system ignitor box and rev limiter test equipment.
8. Demonstrate the use of manufacturers' CDI ignition control module test equipment.
9. Demonstrate the use of computer interfacing to verify manufacturers' ignition specifications.

C. Spark Plugs, Wires, Caps and Coils ..... 6 Hours

Outcome: ***Describe the construction of sparkplugs, sparkplug caps, ignition wires, ignition coils and perform the required inspections or service.***

1. Describe the construction and identify the features of motorcycle sparkplugs.
2. Perform the inspection and service to motorcycle sparkplugs.
3. Describe the construction and identify the features of motorcycle sparkplug caps.
4. Perform a resistance test on motorcycle sparkplug caps.
5. Describe the construction of motorcycle sparkplug coil wires.
6. Perform resistance tests to motorcycle sparkplug wires.
7. Describe the construction of motorcycle ignition coils using secondary circuits with high tension leads.
8. Perform static and dynamic test to ignition coils with high tension leads.
9. Describe the construction of the direct type ignition coil and identify the manufacturers' test procedures.
10. Perform the test procedures specified for direct type ignition coils.

D. Flywheel Magneto Alternating Current CDI Ignition Systems ..... 6 Hours

Outcome: ***Describe the operation of an off road motorcycles' flywheel magneto CDI ignition system and perform the inspections and service specified by the manufacturer.***

1. Identify the components found in an off road motorcycle using a flywheel magneto CDI type ignition system.
2. Describe the operation of the components in a flywheel magneto CDI ignition system.
3. Perform the ignition coil inspection using manufacturers' specified electric test equipment.
4. Perform the CDI unit inspection using a digital multi-meter and identify manufacturers' service specifications.
5. Perform the stator coil inspection using a digital multi-meter and identify the manufacturers' service specifications.
6. Describe the procedure to test CDI ignition systems using a digital multi-meter and a peak voltage adapter.
7. Perform the trigger coil output test and the CDI box output test using a peak voltage adapter.
8. Describe the effect of trigger coil voltage rise time to advance ignition timing.

E. Direct Current CDI Ignition Systems ..... 6 Hours

Outcome: ***Describe the operation of an ATV or motorcycles direct current CDI ignition system and perform the inspections and service specified by the manufacturer.***

1. Identify the components found on an ATV using a direct current CDI ignition system.
2. Describe the operation of the components in a direct current CDI ignition system.
3. Demonstrate using manufacturers' ignition system wiring diagrams to determine circuit test points for voltage inspections.
4. Perform pickup coil and power source coil peak voltage and resistance tests.
5. Perform ignition coil primary circuit peak voltage and resistance tests.

F. Digital Controlled Transistorized Electronic Ignition Systems ..... 12 Hours

Outcome: ***Describe the operation of a sport bike digital controlled transistorized ignition system and perform the inspections and service specified by the manufacturer.***

1. Describe the introduction of digital controlled ignition systems to sport bikes and identify the similarity of earlier electronic ignition components with these systems.
2. Describe the operation of a digital ignitor fully transistorized ignition system and its engine rpm limiting function.
3. Identify the components of a digital controlled ignition system and locate these components on the sport bike.
4. Perform the ignition coil primary peak voltage and the ignition coil resistance tests.
5. Perform the signal generator peak voltage and resistance tests.
6. Demonstrate verifying the operation of the ignition cut-off circuit using manufacturers' electrical test equipment.

G. Engine Management Controlled Ignition Systems ..... 12 Hours

Outcome: ***Describe the operation of an engine management controlled electronic ignition system and perform the inspections and service specified by the manufacturer.***

1. Describe the operation of the engine management controlled ignition system and identify the components in the system.
2. Describe the operation of the fuel cut-off circuit used to control engine rpm limits.
3. Describe the operation of the throttle position sensor and identify the signals it sends to the management system computer.
4. Describe the operation of the engine coolant temperature sensor and identify the signals it sends to the management system computer.
5. Describe the operation of the gear position switch and identify the signals it sends to the management system computer.
6. Perform an ignition coil primary peak voltage and resistance tests.
7. Perform a crankshaft position sensor peak voltage and resistance tests.
8. Describe the use of lap top computers and manufacturers' software to interface with engine management computers and inspect voltage outputs of sensors and ignition components.

H. Ignition, Kill, Interlock Switch Systems ..... 6 Hours

Outcome: ***Describe the operation of ignition interlock shutoff systems and perform the inspections to switches to verify safety systems perform to manufacturers' specifications.***

1. Describe the operation of the side-stand ignition cut-off circuit.
2. Identify manufacturers' wiring diagrams and trace the side-stand ignition cut-off circuit.
3. Demonstrate the test procedures to verify proper operation of the side-stand ignition cut-off circuit.
4. Describe the operation of the ignition kill switch circuit.
5. Identify manufacturers' wiring diagrams and trace the ignition kill switch circuit.
6. Describe the system overlapping of the starter motor clutch switch and neutral switch to the ignition system.

7. Describe the system overlapping of an ATV that uses transfer switch, parking brake switch, neutral parking switch and an ignition starter control relay.

8. Describe the system overlapping of the fuel injection system bank angle sensor and the ignition system.

I. Troubleshooting Common Ignition System Problems ..... 6 Hours

Outcome: ***Describe common ignition related symptoms and perform troubleshooting tests to diagnose the cause of problems.***

1. Describe the symptoms of a no spark or weak spark problem and identify the tests to perform to verify this condition.

2. Demonstrate using tests in a systematic approach to determine the cause of a no spark condition.

3. Describe the symptoms of an intermittent spark under load condition problem and identify the tests to perform to verify this condition.

4. Demonstrate using tests in a systematic approach to determine the cause of an intermittent spark under load problem.

5. Describe the symptoms of an ignition engine rpm cut-off circuit malfunction and identify the tests to perform to verify this condition.

6. Demonstrate using tests in a systematic approach to determine the cause of an engine rpm cut-off circuit malfunction problem.

FOURTH PERIOD TECHNICAL TRAINING
MOTORCYCLE MECHANIC TRADE
COURSE OUTLINE

UPON SUCCESSFUL COMPLETION OF THIS PROGRAM THE APPRENTICE SHOULD BE ABLE TO PERFORM THE FOLLOWING OUTCOMES AND OBJECTIVES.

SECTION ONE:AIR INDUCTION, FUEL AND EXHAUST SYSTEMS AND EMISSION CONTROLS ... 45 HOURS

A. Normal Aspiration and Pressurized Air Systems.....2 Hours

Outcome: ***Describe the typical intake air flow process effect on combustion, and discuss the effects when a manufacturer designs a pressurized air box for the intake system.***

1. Describe the theory of air flow through a typical normally aspirated engine.
2. Describe how a pressurized intake system works.
3. Identify the components of a pressurized air box system using manufacturer's schematic drawings.
4. Perform an inspection of vacuum lines and control valves on a pressurized air box system.
5. Identify the type of air filtering element used and perform the required service.

B. Fuel System Tanks, Valves, Filters and Pumps .....4 Hours

Outcome: ***Describe the operation of the fuel storage and delivery systems and perform inspections or specific tests to determine proper function of all individual components.***

1. Perform an inspection to the fuel storage system and identify any defects with the following components:
   a) clamps, fuel lines, vacuum lines
   b) fuel taps and fuel tap filters
   c) fuel caps and pressure venting systems
   d) fuel overflow and breather line routing
   e) fuel tank internal surface condition and external repaired conditions
   f) fuel type, age, condition, stabilizers and the need to change
2. Describe the operation of an ~~"~~ tank" fuel level gauges and fuel level sensors.
3. Describe the repair procedures for metal fuel tanks with internal rusted surfaces.
4. Describe the operation of external fuel pumps used with carbureted systems.
5. Identify the electrical switches, relays and wiring circuits in an electric fuel pump system.
6. Perform electrical circuit continuity and voltage drop tests on all fuel pump circuit components.
7. Perform a fuel pressure test on a fuel pump used in a carbureted system.
8. Identify ~~"in~~ tank" type fuel pump and filters used for high pressure fuel injected systems.

C. Carburetors and Throttle Operating Systems ..... 6 Hours

Outcome: ***Review the basic operating principles of carburetors, identify additional mechanical compensating circuits, electrical feedback sensors and perform necessary adjustments or service to throttle operating components.***

1. Describe the basic operating principle of the slide type and the constant velocity carburetor.
2. Describe modern flat slide carburetor circuits and compensating devices used for off road motorcycles.
3. Describe the operation of throttle position sensors used on off road motorcycle carburetors.
4. Describe aftermarket modern flat slide carburetors used on cruiser motorcycles.
5. Describe the synchronization procedure used for an engine with multiple carburetors.
6. Describe cold start systems used on carburetors.
7. Describe hot start systems used on off road motorcycle and ATV.
8. Perform a carburetor overhaul on a motorcycle or ATV.
9. Perform a throttle control system inspection, lubrication, adjustment and verify cable routing.
10. Perform an inspection of intake manifolds, air box connector boots and clamps.
11. Perform an inspection of air box and intake silencer devices.
12. Identify air box air temperature sensors and perform resistance tests.

D. Fuel Injection Systems – Early Designs ..... 3 Hours

Outcome: ***Describe the construction, identify the components and explain the operation of early analog and digital processor electronic type fuel injection systems used on motorcycles.***

1. Describe the theory of operation of electronic fuel injection systems using a mechanical air flow meter.
2. Describe the theory of operation of electronic fuel injection systems using three dimensional mapping.
3. Identify the components of the fuel system and the electronic control system used in early fuel injection systems.
4. Describe the test procedures used to verify the correct operation of fuel injection system sensors and control modules.
5. Describe the operation of fuel injection fuel pumps and fuel regulating devices.
6. Perform an inspection on fuel system lines, filters, pump and test fuel pump pressure.
7. Describe the concepts of open loop, closed loop and speed/density as used in electronic fuel injection systems.

E. Fuel Injection Systems with On Board Diagnostic Displays ..... 9 Hours

Outcome: ***Describe the construction, identify the components and explain the operation of current programmed fuel injection systems using on board diagnostic displays.***

1. Describe the precautions to be used when performing servicing procedures to electronic control modules and related electrical connectors with test meters and probes.
2. Identify the components and locations of the fuel, air and electronic control systems used in a programmed fuel injection system.
3. Describe the operating characteristics of all the sensors used to signal the ECM for compensation of injection time (volume).
4. Describe the inspection, removal and installation of all the sensors used to signal the ECM in a programmed fuel injection system.
5. Perform the self diagnostic function in user mode and dealer mode to a programmed fuel injection system.
6. Identify malfunction codes and demonstrate retrieving manufacturer's specified service procedures.
7. Perform a fuel system inspection and pressure test.
8. Describe throttle body construction and perform throttle body inspection.
9. Perform throttle valve synchronization, throttle cable and fast idle cable adjustments.
10. Describe the operation of the intake air system and identify the components.
11. Perform inspections to the intake air system air control valve, damper mechanisms and vacuum switches.
12. Describe the construction and the operation of the fuel injector.
13. Identify fuel injector location and perform fuel injector servicing as recommended.
14. Perform a rear wheel dynamometer test to validate service performed to the programmed fuel injection system.

F. Engine Management Programmed Fuel Injection Systems Using Computer Interfacing Diagnostics ..... 6 Hours

Outcome: ***Describe the theory of operation of engine management systems used for electronic fuel injection systems and demonstrate data acquisition by using computer interfacing with data links.***

1. Describe the theory of operation of an engine management sequential port electronic fuel injection system.
2. Identify the locations and perform an inspection to all fuel system components and mechanical control systems used in the sequential port electronic fuel injection system.
3. Identify electrical test equipment required to perform tests to the engine management and sequential port electronic fuel injection systems.
4. Perform manufacturers' diagnostic tests using portable scan type trouble code readers interfaced with the data link connector of the motorcycles' engine management system.
5. Demonstrate the use of a laptop computer and manufacturers' software for data acquisition and trouble code interpretation on a programmed electronic fuel injection system.
6. Perform an initial base data recording and interpret the data values recorded on a new motorcycle that uses an engine management type programmed electronic fuel injection system.

G. Exhaust Pipes, Mufflers and Catalytic Converters ..... 6 Hours

Outcome: ***Describe the construction, identify components and perform an inspection to motorcycle and ATV exhaust systems.***

1. Describe the construction and explain the theory of operation of a 2-stroke engine exhaust system.
2. Identify off road exhaust system spark arrestors and explain the service procedures for cleaning.
3. Describe the service and maintenance requirements of an off road 2-stroke motorcycles' exhaust system.
4. Describe the construction and explain the theory of operation of a 4-stroke engine exhaust system.
5. Describe the service and maintenance requirements of a cruiser type motorcycle's exhaust system.
6. Describe the service and maintenance requirements of a sport bike type motorcycle's exhaust system.
7. Identify and describe the theory of operation of a sport bike variable volume exhaust system.
8. Identify a motorcycle catalytic muffler system and describe the theory of operation of a catalytic converter.
9. Describe the operation of oxygen sensors used in motorcycle exhaust systems.
10. Describe exhaust system noise levels and explain SAE noise level testing.

H. Exhaust Gas Analysis ..... 6 Hours

Outcome: ***Demonstrate using a 4/5 exhaust gas analyzers to diagnose engine operation problems.***

1. Review the basic combustion process and describe the elements of air, fuel and exhaust gas.
2. Describe the history of motorcycle exhaust gas analysis and identify an early two gas analyzer.
3. Describe modern terminology used for air to fuel ratios.
4. Describe the operating principals of a 4/5 gas analyzer and identify the gases monitored.
5. Demonstrate the use of a 4/5 gas analyzer.
6. Demonstrate the cleaning and maintenance of the 4/5 exhaust gas analyzer.
7. Describe the typical readings for a normal running engine and determine problems if they are out of specification.

I. Emission Control Systems ..... 3 Hours

Outcome: ***Describe the combustion process, the resulting emissions and how air/fuel ratio, ignition timing and engine modifications affect emissions.***

1. Identify the normal emissions from the combustion process and describe how engine wear or modifications affect these emissions.
2. Describe the history of emission control systems on motorcycles with specific reference to air box vented crankcase breather systems.
3. Describe the operating principles of the air-shot emission control systems.
4. Describe the operating principles of the exhaust port fresh air injection systems.

SECTION TWO: .....LOWER END SERVICE (CRANKSHAFT AND TRANSMISSION) ..... 75 HOURS

A. Primary Drive Construction and Inspections (Review) ..... 3 Hours

Outcome: ***Describe the construction of primary drive systems and inspect the primary drive system for adjustments or wear.***

1. Describe the construction and identify the adjustments required for chain type primary drives.
2. Perform an inspection to a chain type primary drive and interpret problematic sounds.
3. Describe the construction and identify the components that wear in gear type primary drives.
4. Describe test procedures used to determine if engine noise is crankshaft or primary drive related.
5. Demonstrate using a rear wheel dynamometer to test for bottom end related noise problems.
6. Demonstrate using a rear wheel dynamometer to test for transmission shifting problems.
7. Demonstrate using a rear wheel dynamometer to test for clutch related problems.
8. Describe using a test ride to verify bottom end problems and identify safety considerations.

B. Engine Diagnostics, Removal and Disassembly ..... 3 Hours

Outcome: ***Describe engine diagnostic test procedures and identify special tools or specified manufacturers' procedures for engine removal and disassembly.***

1. Perform an oil pressure test to indicate possible crankshaft bearing or connecting rod wear problems.
2. Perform a stationary heavy loaded test to the engine to determine crankshaft bearing problems.
3. Perform an engine sounds test using a stethoscope or alternative diagnostic tool.
4. Describe the engine removal procedure outlined in a manufacturers' service information for a v-twin cruiser bike.
5. Describe and demonstrate the use of engine lifting devices and engine stands.
6. Describe the proper use of generic type holding devices and pullers to aid in engine disassembly.
7. Describe manufacturers special tools required for disassembly of an ATV with CVT type transmission.
8. Describe the procedure for identifying and tagging mating parts or components.
9. Describe the removal of gasket materials and perform cleaning of engine parts.
10. Describe the inspection and preparation of chassis for storage and later engine re-installation.

C. Anti-Friction Bearings Nomenclature, Inspection and Installation ..... 3 Hours

Outcome: ***Identify rolling element type bearings used in motorcycle engines; describe their construction, inspection, handling and installation procedures.***

1. Identify the different types of anti-friction type bearings used in motorcycle and ATV engines.
2. Describe the construction and operating characteristics of anti-friction bearings.
3. Describe the inspection and measurement procedures used for anti-friction bearings.
4. Describe the recommended methods used for bearing removal and installation.
5. Describe the assembly lubricants to use on various motorcycle anti-friction bearings.
6. Describe the construction and the installation of engine seals used with anti-friction bearings.

D. 2-Stroke Engine Crankcase and Crankshaft Overhaul ..... 12 Hours

Outcome: ***Describe the disassembly, inspections and overhaul of a single cylinder 2-stroke engine and perform the replacement procedure of a connecting rod assembly to a 2-stroke crankshaft.***

1. Describe the 2-stroke engine crankcase seal leak test using the pressure and vacuum methods.
2. Describe measuring crankshaft and transmission shaft end plays.
3. Describe inspecting crankshaft main bearing radial clearance and observing crankshaft seal integrity.
4. Describe top end disassembly, inspection, cleaning and storage of components for re-assembly.
5. Describe measuring connecting rod small end and connecting rod big end radial and side clearances.
6. Demonstrate the crankcase splitting procedure using manufacturer's approved tools and procedures.
7. Perform the connecting rod replacement procedure to a 2-stroke single cylinder crankshaft.
8. Demonstrate the connecting rod replacement procedure to a "tin can" style crankshaft using the IMS equipment.
9. Describe the crankshaft inspection and alignment procedure used for a multi-cylinder 2-stroke engine crankshaft.
10. Describe crankcase and crankshaft seal or bearing replacement procedures.
11. Describe the cleaning of crankcase joint surfaces and the application of joint sealing compounds.
12. Demonstrate the installation of the crankshaft into the crankcase and identify manufacture's special tools.
13. Describe the assembly of the top end components.
14. Describe engine installation into the chassis and perform adjustments required.
15. Describe initial start up procedures and heat cycling procedures.
16. Describe break-in time intervals and post break-in required adjustments.
17. Describe the similarities of the 4-stroke single cylinder built up type crankshaft.

E. V-twin Engine Crankshaft and Crankcase Overhaul.....9 Hours

Outcome: ***Describe 4-stroke air cooled v-twin engine, disassembly, overhaul, re-assembly and perform inspections to the crankshaft and cam gear case areas.***

1. Describe past and present procedures for removing the engine from the chassis.
2. Describe top end disassembly, inspections, cleaning and storage of components for re-assembly.
3. Demonstrate inspecting connecting rod small end condition and measuring connecting rod trueness.
4. Demonstrate measuring connecting rod big end bearing radial clearance and side clearance.
5. Describe camshaft and gear case disassembly, inspections, cleaning, storage and reassembly.
6. Describe oil pump inspections and recommended service or overhaul.
7. Demonstrate crankshaft end float measurement and pinion shaft run-out measurement procedures.
8. Describe crankcase splitting and identify common tools and procedures used.
9. Describe 3 piece crankshaft disassembly, inspection, measurement, re-assembly and alignment procedures.
10. Describe inspection of the late model pressed in pin type crankshaft assembly.
11. Describe the replacement procedures for crankcase main bearings and seals.
12. Describe the re-assembly procedure for installing the crankshaft into the crankcase halves.
13. Identify crankcase joint surface compounds and describe their application.
14. Describe installation of the top end components and priming of the oiling system.
15. Describe installing the engine into the chassis and performing necessary adjustments.
16. Describe initial start-up and heat cycling procedures.
17. Describe recommended break-in and post break-in adjustments required.

F. Friction Type Bearings Nomenclature, Inspections, Replacement.....3 Hours

Outcome: ***Identify friction type (plain) bearings used in motorcycle engines; describe their construction, inspection, handling and installation procedures.***

1. Identify the types of plain bearings and bushings used in motorcycle engines.
2. Describe the construction of plain bearings used in modern 4-stroke engine crankshafts.
3. Describe the construction of bushings used in modern 4-stroke engines.

G. 4 Cylinder Engine Crankshaft and Crankcase Inspection and Overhaul ..... 12 Hours

Outcome: ***Describe the disassembly, inspection and overhaul of the 4 cylinder in-line engine crankshaft and perform the bearing clearance measurement and replacement bearing selection procedure.***

1. Describe the bearing selection procedure used for a minor crankshaft reconditioning of oil clearances.
2. Describe the bearing selection procedure and the crankshaft journal re-sizing operation for a major crankshaft reconditioning process.
3. Perform the crankshaft and connecting rod bearing measurement procedure outlined by the manufacturer.
4. Describe inspecting the crankshaft and crankcase halves for trueness on horizontal split crankcases.
5. Describe the inspection of engine balancer bearing clearances and timing of the balancer mechanism.
6. Describe the similarities used in v-four crankshaft bearing selection and identify the different crankshaft types.

H. Crankshaft Balance Factors and Crankshaft Balancer Systems ..... 3 Hours

Outcome: ***Explain the theory of crankshaft balance factors used in single cylinder and v-twin motorcycle engines and describe the operation of single or dual counter rotating balancer system used in motorcycle engines.***

1. Explain the theory of obtaining a crankshaft static balance factor for a single cylinder engine.
2. Describe the theory of obtaining crankshaft balance factors for v-twin and multi-cylinder engines.
3. Describe the similarity and the differences of v-twin engine crankshaft designs.
4. Describe the theory of operation of a single or dual counter rotating crankshaft balancer systems.
5. Demonstrate performing the measurements and static balancing a v-twin crankshaft.
6. Describe the inspection and timing procedures used for v-twin crankshaft balancer systems.
7. Describe the operation of secondary vibration counter balancing systems.

I. Transmission Manual Shift Mechanisms ..... 6 Hours

Outcome: ***Identify common transmission manual shift mechanisms, describe their operation and perform inspections and adjustments to ensure proper operation.***

1. Identify the parts and components of the common types of transmission external shift mechanism.
2. Describe the inspection procedures used to verify proper operation of the external shift mechanism.
3. Perform an inspection and adjustment procedure to an external shift mechanism.
4. Identify the parts and components of the drum type internal gear selector mechanism.
5. Describe the operation of the drum type internal gear selector mechanism.
6. Perform inspections and measurements to the components of the drum type internal gear selector mechanism.
7. Identify the parts and components of the cam plate type internal gear selector mechanism.

8. Describe the parts and components of the cam plate type internal gear selector mechanism.
9. Perform inspections and measurements to the components of the cam plate type internal gear selector mechanism.

J. Indirect Drive Multi-Speed Transmissions ..... 9 Hours

Outcome: ***Identify common multi-speed indirect drive type transmission components, describe the operation of the transmission in each ratio, and perform the required inspection to determine abnormal wear levels.***

1. Identify the parts of a common indirect drive type multi-speed transmission.
2. Describe transmission ratios and determine the gears required to transfer power in each ratio.
3. Describe the inspection and measurement procedures for all transmission gears and shafts.
4. Perform the disassembly, inspection and reassembly of an indirect drive transmission.
5. Identify common transmission wear areas and determine the causes.
6. Describe transmission neutral locating systems and identify bench shifting verification procedures.
7. Describe transmission shim location and perform gear engagement inspections.

K. Direct Drive Multi-Speed Transmissions ..... 9 Hours

Outcome: ***Identify common multi-speed direct drive type 5 speed transmission components, describe the operation of the transmission in each ratio, and perform the required inspection to determine abnormal wear levels.***

1. Identify the parts of a common direct drive type multi-speed transmission.
2. Describe transmission ratios and determine the gears required to transfer power in each ratio.
3. Identify transmission seals, describe replacement procedures and perform an inspection for leaks.
4. Describe the inspection and measurement procedures for all transmission gears and shafts.
5. Perform the disassembly, inspection and reassembly of an indirect drive 5 speed transmission.
6. Identify common transmission wear areas and determine the causes.
7. Describe transmission neutral locating systems and identify bench shifting verification procedures.
8. Describe transmission shim location and perform gear engagement inspections.

L. Shaft Drive Engine Secondary Bevel Gear Systems ..... 3 Hours

Outcome: ***Describe the construction of an engines' shaft drive secondary bevel gear system and identify similarities of inspections with a shaft drive final drive gear case.***

1. Identify the parts and components in a transmissions' secondary bevel gear drive system.
2. Describe routine maintenance procedures to the internal and external type secondary bevel gear systems.
3. Describe the inspections and measurements required to overhaul the secondary bevel gear system.
4. Identify similarities between secondary bevel gear drives and final drive gear case components.
5. Describe the operation of the cam type damper mechanism used with secondary bevel gear systems.

SECTION THREE: .....ACCESSORY SYSTEMS, COLLISION REPAIR..... 30 HOURS
..... AND MOTORCYCLE INSPECTIONS

A. Sidecar Installation (Legalities)..... 2 Hours

Outcome: ***Describe the installation procedures and explain the legalities involved in sidecar installation.***

1. Identify information on how to install a sidecar and describe the legalities involved.
2. Identify information on the safe operation of a motorcycle with a side car installed.

B. Trailer Hitches (Legalities)..... 1 Hour

Outcome: ***Identify the legalities involved in trailer hitch installation.***

1. Identify and interpret the legalities involved in installing trailer hitches onto motorcycles.
2. Identify information on aftermarket motorcycle trailer hitch manufacturers.

C. Cruise Control Systems..... 6 Hours

Outcome: ***Describe the operation, identify the components and diagnose problems related to vehicle speed control systems.***

1. Describe the operation of an electric servo motor controlled motorcycle cruise control system.
2. Describe the operation of a vacuum accumulator valve controlled motorcycle cruise control.
3. Identify cruise control components and inspect adjustments of throttle operating cables.
4. Perform a cruise control diagnostic test as specified by the motorcycle manufacturer.
5. Describe the proper operation of a motorcycle cruise control under riding conditions.
6. Perform cruise control cable lubrication and adjustments.

D. Instrumentation and Warning Light Systems ..... 3 Hours

Outcome: ***Describe the operation, inspect the performance and diagnose problems with various instruments, panel gauges and warning systems.***

1. Describe the operating characteristics, inspect the components and replace defective parts to repair the following:
   a) oil pressure gauge, sensor and warning light
   b) coolant temperature gauge, sensors and warning lights
   c) tachometer and speedometer
   d) fuel level gauge, warning light and sensors
   e) suspension low air warning system
   f) gear position indicator and neutral warning light

E. On Board Computers ..... 2 Hours

Outcome: ***Describe the operation of microprocessor based motorcycle modules and computers.***

1. Describe the history of on board computers used on motorcycles to control ignition systems, fuel injection systems and engine management systems.
2. Identify the location of on board computers and describe the diagnostic tests to verify computer integrity.
3. Describe computer fault codes and perform locating applicable service data to determine defective components in the system.
4. Describe interfacing on board computer systems with laptop computers and manufacturers' software programs to perform diagnostics.

F. Digital Information Displays ..... 1 Hour

Outcome: ***Describe the operation and inspect the functions of computer controlled digital information displays.***

1. Identify liquid crystal displays (LCD) and inspect the display for proper sequencing of data.
2. Identify light emitting diode displays (LED) and inspect the diode for accurate switching.
3. Identify computer interface ports in a motorcycle's wiring harness and describe computer data displays.

G. Collision Damage Estimates ..... 6 Hours

Outcome: ***Describe how to inspect a motorcycle or ATV damaged in a collision, and perform writing up a collision damage estimate report.***

1. Describe the procedure to perform a collision damage inspection report.
2. Describe the methods and tests used to verify hidden damage caused by a collision.
3. Perform the inspection and write up an estimate of repairs for a motorcycle involved in a collision.

H. Frame Alignment and Inspection ..... 3 Hours

Outcome: ***Demonstrate the procedures to inspect frame alignment and suspension trueness.***

1. Describe the procedure used to verify front fork tube trueness on the motorcycle.
2. Describe the procedure used to verify rear swing arm as in manufacturer's tolerances.
3. Perform the string method to verify frame alignment and wheel offset is within specification.
4. Perform the parallel bar method to verify frame alignment and wheel offset is within specification.
5. Demonstrate the laser alignment method to verify frame, suspension and wheel offset is within specification.

I. Out of Province & Salvage Inspections ..... 3 Hours

Outcome: ***Describe inspection procedures and regulations pertaining to Out of Province or Salvage Inspections.***

1. Describe regulations that pertain to Out of Province and Salvage Inspection Program.
2. Describe the responsibilities of the mechanic and the shop in performing the inspection.
3. Identify the inspection procedure and necessary documentation.
4. Identify inspection manuals and check sheets required for the inspection.
5. Demonstrate the inspection process on a current low kilometre motorcycle.
6. Describe the inspection procedure for a repaired motorcycle that will be re-certified with a salvage registration.

J. Road Test ..... 3 Hours

Outcome: ***Describe verification of repairs using a road test or an alternate such as a rear wheel dynamometer.***

1. Describe the safety considerations and specific riding manoeuvres to be performed during a road test to verify collision damage repairs have been satisfactorily completed.
2. Perform a rear wheel dynamometer test procedure to verify engine hidden damage and final drive system repairs have been satisfactorily completed.

SECTION FOUR: ..... TROUBLESHOOTING MOTORCYCLE AND ATV SYSTEMS ..... 30 HOURS

A. Basic Troubleshooting Techniques and Using a Systematic Approach ..... 6 Hours

Outcome: ***Identify the types of problems attributed to malfunctions and procedures used to troubleshoot them.***

1. Describe the steps used to perform a complete troubleshooting procedure.
2. Describe the identification and interpretation of symptoms used in troubleshooting.
3. Describe the identification of the system involved and discuss system overlapping.
4. Describe the tests and conclusions when a permanent failure is the problem.
5. Describe the tests and conclusions when an intermittent failure is the problem.
6. Describe the record keeping process used for troubleshooting.
7. Describe the verification procedure used after repairs have been completed.

B. Troubleshooting Electrical System Problems ..... 6 Hours

Outcome: ***Identify the types of problems and perform the necessary tests to determine the correct repair procedures for various electrical problems.***

1. Describe the symptoms and the test procedures used to diagnose a low charging system output problem.
2. Perform the test procedures and record the data for a low charging system output problem.
3. Describe the symptoms and the test procedures used to diagnose a high charging system output problem.
4. Describe the symptoms and test procedures used to diagnose a slow turning electric starter motor.
5. Perform the test procedures and record the data for a slow turning electric starter motor.
6. Describe the symptoms and the test procedures for an intermittent brightness problem at a headlight high beam.
7. Perform the test procedures and record the data for an intermittent insufficient brightness high beam.
8. Describe the test equipment and procedures to diagnose wiring harness related problems.

C. Troubleshooting Chassis, Suspension and Brake Problems ..... 6 Hours

Outcome: ***Identify the types of problems and perform the necessary tests to determine the correct repair procedures for various suspensions or brake related problems.***

1. Describe the symptoms and the test procedures to diagnose a high speed weave handling problem.
2. Perform the test procedures and record the data for a high speed weave problem.
3. Describe the symptoms and the test procedures to diagnose a rear wheel hop problem during braking.
4. Perform the test procedures and record data for a rear wheel hop problem during braking.
5. Describe the symptoms and the test procedures related to front disc brake poor performance problems .
6. Describe the symptoms and the test procedures related to a front fork bottoming problem.
7. Perform the test procedures and record data for a front fork bottoming problem.
8. Describe the symptoms and the test procedures for chassis and engine misalignment.

D. Troubleshooting Power Driveline Problems ..... 6 Hours

Outcome: ***Identify the types of problems and perform the necessary tests to determine the correct repair procedures for various problems related to the transfer of power from the engine crankshaft to the rear wheel.***

1. Describe the symptoms and the test procedures used to diagnose a noisy primary drive problem.
2. Perform the test procedures and record the data for a noisy primary drive problem.
3. Describe the symptoms and the test procedures used to diagnose a poor acceleration problem with an ATV using a CVT type transmission.
4. Perform the test procedures and record the data for a poor acceleration problem on an ATV using a CVT type transmission.

5. Describe the symptoms and the test procedures used to diagnose a noisy shaft drive final drive system problem.

6. Perform the test procedures and record the data for a noisy shaft drive final drive system.

7. Describe the symptoms and the test procedures used to diagnose a transmission that jumps out of gear problem.

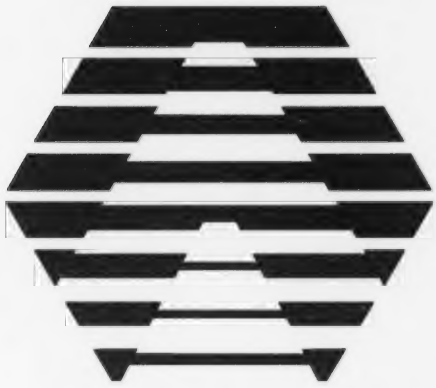
8. Describe the symptoms and the test procedures used to diagnose an engine that knocks under load problem.

E. Introduction to Workplace Coaching Skills ..... 6 Hours

Outcome: ***Describe the basic steps used in the coaching skills program that will aid the journeyperson mechanic with the on the job training portion of a new employees' apprenticeship.***

1. Describe the following workplace coaching skills used for training apprentices:

   a) identifying the point of the lesson
   b) linking the lesson
   c) demonstrating a new skill
   d) providing the opportunity to practice a skill
   e) giving feedback to the learner
   f) assessing the apprentices' learning progress



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